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ARTICLE I.

ON THE STONE FIGURES AT CHINESE TOMBS AND THE OFFERING OF LIVING SACRIFICES.

By William Frederick Mayers,

*Chinese Secretary of Her Britannic Majesty's Legation at Peking.**

THE practice of adorning the approaches to tombs of sovereigns and dignitaries of State in China with an avenue of stone figures of various kinds is well known, and has frequently formed a subject of speculation among European enquirers; but no attempt to assemble the data to be found on this subject in Chinese literature appears as yet to have been made. It may be useful, therefore, to collect for purposes of reference such information as has been met with by the writer in connection with the usage.

The most striking instance of the practice in question, and one which is annually brought under the notice of visitors to the neighbourhood of Peking, is the extraordinary avenue of colossal figures by which the Mausoleum of Yung Loh, the great emperor of the

(*) This paper was read before the Society on the 12th March 1878. Mr. Mayers died at Shanghai on the 23rd. The Editorial Committee feel they cannot allow the occasion to pass without an expression of the deep regret felt by all classes at his early death. As a deeply read and accurate scholar Mr. Mayers had won an honourable position. and students of Chinese owe him a debt of gratitude for the thorough manner in which he opened up many of the most abstruse fields of Chinese literature and practice.—*Ed*

Ming dynasty, (died A. D. 1424), is approached. In his paper on the Architecture of China, read before the Royal Institute of British Architects on the 1st December, 1873, Mr. William Simpson describes this avenue in the following terms:—

"Then began one of the noted features of the Ming Tombs, that is, a long *dromos* with colossal stone figures on each side. This strange approach is nearly a mile in length.—There are thirty-two figures in all, twenty of them being animals, and twelve are human. They are in pairs, opposite each other, and facing the roadway. First are two griffins couchant, then two standing; two camels recumbent, and two standing: then elephants, asses, and horses grouped in the same way. The human effigies seem to be those of warriors and priests. They are all of stone, and although not executed in what we understand by rude art, yet they are not of a high class of work. I felt in looking at them how superior the conventional forms of Egyptian art were for such purposes."

The description given by the Rev. Dr. Edkins, in his chapter on Peking, forming an Appendix to the Rev. A. Williamson's *Journeys in North China*, (Vol. II, p. 387), of the avenue of figures at the Tomb of Yung Loh, is somewhat more minute and accurate than that of Mr. Simpson above quoted, and the liberty may be taken of reproducing it here. Dr. Edkins says:

"There are two pairs of lions, two of unicorns, two of camels, two of horses. One pair stands, and the other pair sits or kneels. The elephants are thirteen feet high, by seven wide, and fourteen feet long. Beyond the animals come the military and civil mandarins, of whom there are on each side six. Each figure is also one stone. The military figures are carved to represent coats of mail extending to the knees with tight sleeves. A round cap covers head and ears, and hangs to the shoulders. The left hand holds a sword, the right, a bâton or *ju-i*. The civil officers have long hanging sleeves, with a sash round the waist, which falls to the feet before and behind with a long tassel. They wear a square cap under which their long ears are exposed. The girdle consists of embroidered squares. The square embroidered breastplate is fastened by a sash round the neck which hangs down the back."

The avenue at the *Ch'ang-ling* 長陵, or tomb of the emperor Yung Loh, described above, is the most imposing in style and the most perfectly preserved (*) of all that is open to view of this

(*) Mr. Simpson is in error in remarking in his paper that "as the Ming dynasty ended in 1628 [this is a mistake for 1643] their tombs have had no one since that period to discharge the necessary services,"—i.e the performance of religious rites. An officer of the Court is, on the contrary, sent twice a year from Peking to offer sacrifices at the tombs of the Ming

description of statuary work in China. A similar avenue leading to the tomb of Hung Wu, the founder of the Ming dynasty (died A. D. 1398), near Nanking, has suffered from the ravages of both time and war, but it still preserves enough of its ancient dignity and proportions to furnish an interesting sight to the visitor. In the neighbourhood of the cities of Shanghai, Amoy, Chefoo, and probably others among the Treaty ports also, the tombs of deceased servants of the present dynasty are to be seen, at which figures of the same description, although less in number and of smaller size, than those which keep watch over the burial places of the departed Sovereigns near their respective capitals, are erected. In the vast walled enclosures containing the tombs, sacrificial halls, and other buildings which, collectively, form what is known as the Mausoleum of each emperor of the dynasty now occupying the throne of China, similar avenues of colossal figures exist, but the jealous manner in which these sacred places are guarded against the intrusion of visitors makes them inaccessible to Europeans. The *Hwang Ling* (*) or Imperial tombs of the present dynasty are situated in the mountain range to the north of Peking, occupying two separate tracts, which lie respectively east and west of the capital, at a distance of about 100 miles on either hand. Successive sovereigns and their consorts should be interred, according to the system originally contemplated, in alternate order at one or the other of these sites; but the eligible spots in the Western Hills having now been almost entirely occupied, recent interments have taken place at the Eastern Mausolea only. The *Ta Ts'ing Hwei Tien*, or Collected Institutes of the reigning dynasty, furnishes some information relating to the avenues of figures with which the earlier Mausolea are provided. On the subject of the Imperial tombs, as upon every other detail of the Chinese administration, prescriptive rules are placed on record, with an astonishing minuteness of detail, for execution by the department severally concerned; and, although the actual dimensions and precise style of adornment of each Imperial tomb are not immutably prescribed,

dynasty; and all existing tombs of former rulers are carefully watched over in theory at least, by the present occupants of the Throne.

(*) 皇陵. The use of the term *ling*, properly signifying a high mount or peak, in the sense of a burial mound or tumulus, dates from a period of remote antiquity. Perhaps the earliest special notice of the expression is that contained in the *Fêng Suh T'ung* 風俗通, the well-known antiquarian treatise by Ying Shao, who wrote about the middle of the 2nd century of our era. He remarks that the tomb of Hia How Kao (B C. 1848) is mentioned in the *Tso Ch'wan* under the name of *Nan Ling*; and he adds that in his own day the tumuli under which princes and nobles were buried were all designated as *Ling*. (*Fêng Suh T'ung*, Book 10).

being left to the filial piety of the succeeding sovereign and to the management of the high Commissioners appointed, whenever necessary, for the execution of such works, the details of the buildings heretofore constructed are minutely recorded in this official compilation. (*) At the *Hiao Ling* 孝陵 or tomb of the emperor Shun Che, the first sovereign of the present dynasty, it is recorded, there are placed in front of the grand gateway, called the *Lung Feng Men*, 龍鳳門, a row of stone figures representing living beings 前列石像生 (i.e. statues) as follows, namely: 3 pairs each of figures of civil and military officers of State, in court dress and in helmet and armour respectively, and 1 pair each of recumbent and of standing *Ki-lin*, lions (*she* 獅), elephants, horses camels, and *swan-ni*, (†) making eighteen pairs in all, beside two *wang chu* 望柱 or pillars, measuring two *chang*, two *ch'ih*, seven *ts'un* in height.

The embellishment of the avenue leading to the tomb of K'ang Hi is somewhat different. Here, it is noted, there are one pair each of statues of civil and military officers of State, clad as above described, and three pairs of standing figures of horses, elephants, and lions, making five pairs in all with two pillars as above. The tomb of Yung Chêng is guarded in a precisely similar way, but a variation occurs again at the last Mausoleum of which a description exists in print, that of the emperor K'ien Lung: Here, in addition to 1 pair each of human figures, six kinds of animals are represented, all standing, viz., horses, *Ki-lin*, elephants, camels, *swan-ni*, and *she*, making eight pairs of figures in all.

As has already been observed, no precise regulation appears to be in force respecting this mode of decorating the approach to an Imperial tomb, and in some cases the avenue of figures may be altogether omitted. The emperor Tao Kwang, it is reported, ex-

(*) Cf. 大清會典事列 Book 711, p. 6, under head of, 工部 or Board of Works.

(†) The 狻猊 *swan-ni* and the lion are recognised by the Chinese as one and the same creature, although the designation 獅 *she* is most commonly given to the real animal, and, as is to be seen above, distinct conceptions exist in relation to the objects which bear the two separate names. The *Swan-ni* is usually depicted in the shape of a lion, but with uplifted head, as though in the act of roaring. The Chinese appear to have obtained their earliest knowledge concerning the lion under the name *swan-ni*, which is found in the *Muh T'ien Tsze Chwan*, the *Urh Ya*, and other ancient works; but in the second century after Christ a live lion was sent by way of tribute from Su-lĕh (Kashgar) to the court of Shun Ti of the Han dynasty, and the name She 獅 appears then to have been devised for it, as signifying the Lord of Beasts.

pressly forbade the erection of such figures in front of his own place of sepulture, but whether this prohibition was inspired by a desire to obviate a lavish expenditure or by superstitious ideas is not generally known. Some eminent professors of the science of *Feng Shui*, which deals so largely with the aspect and construction of tombs, are opposed to the placing of lines of upright objects along the *Shên Tao* 神道 or Spirit's Road, *i. e.* the avenue leading to the tomb. Whatever may have been the ground of the objection entertained by the emperor Tao Kwang, this did not prevail with his son and successor Hien Fêng, (died 1861), at whose Mausoleum the customary stone figures are known to have been erected; (*) and the same course is reported to have been followed at the mausoleum of the emperor T'ung Che, his son and successor (died 1875), the works upon which are barely completed as yet.

The license which appears to be taken in connection with the adornment of imperial tombs is not extended to that affecting the burial places of the most distinguished nobles and public functionaries. The *Ta Ts'ing T'ung Li* or Ritual Ordinances of the present dynasty (†) contains some regulations on this subject which are worth noting. The text is as follows:—

"For officials of the first rank, the burial ground shall measure 90 *pu* (of about 6 feet each) from the centre of the grave-mound to each side of the quadrangle, and the tumulus shall be 1 *chang* 6

(*) As the method by which the material for these colossal effigies is conveyed to the spot at which they are hewn into shape is doubtless the same at present with that employed in remote antiquity, it may be useful to include some account of it here from personal observation. The limestone quarries of the Fangshan district, situated about 50 miles from Peking, furnish the blocks which are carved into the shapes traditionally consecrated to the guardianship of the tombs; and for the completion of the mausoleum of Hien Fêng it was necessary to transport masses of stone, estimated as weighing not less than six tons each, to a distance of about 90 miles eastward from Peking, or about 140 miles in all. The huge square blocks are so quarried out as to be allowed, when finally detached, to sink to rest upon two longitudinal beams, which are subsequently raised to a sufficient extent to allow two pairs of wheels, consisting of solid blocks of wood roughly hewn into a circular shape, to be placed beneath them and connected by axles. From these axles are suspended two enormous parallel hawsers, hanging but a few inches above the ground, and extending for many yards in front of the truck. On either side of the hawsers there are fastened, at short distances apart, transverse lengths of drag-rope, to each of which a pony, mule, or donkey is harnessed, and by these means some hundred or hundred and fifty animals may be brought to bear on the task of conveying the monolithic mass to its final destination. Special roads are prepared, when necessary, to facilitate the removal.

(†) Cf. 大清通禮, edition of 1824, Book 52, p. 16.

ch'ih high. For the second rank, the dimensions shall be 80 *pu* and 1 *chang* 4 *ch'ih*.......and for the seventh rank, 20 *pu* and 6 *ch'ih*. The ground shall be walled in......Stone effigies shall be erected, to wit: for individuals from the first order of nobility (*kung*) down to the second official rank, there shall be set up one pair each of human figures, horses, tigers, goats, and pillars. For the third rank, the pair of human figures shall be omitted. For the fourth rank, the human figures and the goats shall be omitted; and for the fifth rank, the human figures and the tigers shall be omitted. At the gateway of the tomb, a tablet shall be erected, setting forth the rank and name of the deceased (or, in the case of females, the title bestowed upon her by imperial patent and her maiden family name). For the first three orders of nobility (*kung, hou, pêh*) the tablet shall be 9 *ch'ih* in height and 3 *ch'ih* 6 *ts'un* wide, crowned with a dragon border and supported upon the back of a tortoise. (*) The crowning border is to be 3 *sh'ih* 2 *ts'un* high, and the support 3 *ch'ih* 8 *ts'un* high......A similar style of tablet, but of somewhat smaller dimensions, is accorded in the case of an official of the first rank; whilst for those of the second the crowning border is to represent the head of the *Ki-lin* instead of that of the dragon."

(*) 螭首龜趺—*li show kwei fu*—lit. dragon-headed and tortoise crouching. Monumental tablets thus adorned and supported are familiar to the eye of most residents or travellers in China. The tortoise, *kwei*, in one of its mythical developments is regarded as the type of strength and endurance, and hence it appropriately supports on its back the tablet intended to perpetuate a record. With reference to the dragon-headed ornament, Chao Yen-wei, 趙彥衞, an author of the 12th century, in his Collectanea entitled *Yun Li Man Ch'ao* 雲麓漫抄 (Bk. 1, p. 7) states that in the palaces of the sovereigns of the T'ang dynasty the carving of the balustrades of the stone staircases was in this shape; and that in his own day it was commonly to be seen in Buddhist temples.

In this connection it may not be out of place, as an illustration of the rise of Chinese architectural fancies, to quote from another collection of miscellanies of the same period, the *Meh K'eh Hwei Hi* 墨客揮犀, by P'eng Ch'êng 彭乘, an account of the introduction of the figures of fishes which, with curved, uplifted tails, are to be seen crowning the roofs of most large Chinese temples. The author says (Bk. 5, p. 6):—

"Owing to the frequent conflagrations of the palaces of the Han dynasty, the soothsayers gave counsel that figures should be made representing the 'fish-tail constellation' in the Heavens, and placed upon the tops of houses, as a talisman against the evil. At present, since the days of the T'ang dynasty, one sees upon the roofs of old temple buildings figures which resemble a fish in the attitude of flying, with its tail pointing upwards: I know not when the name became changed to that of *ch'ih wen* 鴟吻. The tail is not like that of a fish."

Such being the state of the case as regards custom and ordinance in connection with this practice, the principle or tradition underlying the system may now be investigated so far as available means permit. The only recent Chinese author who is known to have occupied himself with the question is Wu Yung-kwang, in his treatise upon the laws and institutions of the reigning dynasty, published by him while holding office as Governor General of Hu kwang in 1832. (*) In Book 17, p. 3, under the head of Funereal Rites, the following note is appended to the extract given from the *Ta Ts'ing T'ung Li* on the subject of the *Shih Siang Shêng* 石象生 or Stone Figures at tombs:—

"With reference to the usage of erecting these stone effigies, the *Feng Suh T'ung* (†) has the following statement: 'The *wang siang* (‡) was a thing which was addicted to devouring the liver and brains of the dead; and for this reason [the functionaries termed] the *fang siang she* were used, on the day of interment, to go into the vault to drive away these things. Beside this, a *fang siang* was set up at the side of the tomb; and as the *wang siang* stood in awe of cypresses 柏 and of tigers, cypresses were planted and [figures of] tigers erected in front of the tomb. At the tomb of Chao K'i, the Governor of Tsing-yang under the Han dynasty, stone columns were erected; and at the tomb of Hoh K'ü-ping (§) stone figures of men and horses were arrayed.' The work entitled Chih Kuh Tsze (‖) says: 'Since the times of the Ts'in and the Han dynasties, stone figures of human beings, goats and tigers, and pillars of stone, have been erected, like the procession of attendants who waited on the deceased during life.' The above

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(*) The work is entitled *Wu Hioh Luh Ch'u Pien*, 吾學錄初編, and consists in a compilation of the ordinances and statutes contained in the *Ta Ts'ing Hwei Tien* and *Ta Ts'ing Luh Li*, etc., with explanatory notes and historical illustrations.

(†) The work of Ying Shao of Han Dynasty, already referred to in a note above. The passage quoted above is not to be found in two separate editions of Ying Shao's work in the possession of the writer, but it may be traditionally ascribed to his pen in some repertory consulted by Wo Yung-kwang, which has not been identified.

(‡) 罔象. This term, with that of *fang-siang-she*, 方相氏, will be explained farther on.

(§) 霍去病, the famous general of Wu Ti of the Han dynasty, who is believed to have brought back to China from a campaign in Kashgaria the first image of Buddha seen in China. He died in B. C. 117.

(‖) 炙轂子,—the work of a writer named Wang Jui 王睿 of the T'ang dynasty. It is described in the *Chih Chai Shu Luh*, a catalogue dating from the Sung dynasty, Book 10, p. 16, as being a compilation from some earlier collections of Miscellaneous jottings.

indicates the origin of the practice of erecting these effigies of men and animals. The statues of human beings are sometimes called *wêng chung*. (*) and the stone pillars are similarly called by the alternative name *hua piao* 華表."

Before going farther, some explanation may be given with regard to two of the terms comprised in the extract attributed to the *Fêng Suh T'ung*. The *wang siang* 罔象 is an imaginary monster of which mention is not unfrequently found in Chinese works. Sze-ma Ts'ien, in his life and history of Confucius (史記, 孔子世家) speaks of the "monstrous dragons and *wang siang* which exist in the waters;" and Hwai Nan Tsze is also quoted as declaring that the *wang siang* is a product of the waters. (†) Although this is not explicitly stated by any Chinese authority, there is reason for believing that the *wang siang* is the same with that elsewhere described as the *yun* 蝹, a creature mentioned in the apocryphal work entitled the *Shuh I Ki* 述異記, which in its present form is supposed to date from the period of the T'ang dynasty. In this work the following passage occurs: (‡) In the reign of Muh Kung, sovereign of Ts'in (died B.C. 621), a certain man of Ch'ên Ts'ang was digging in the ground, when he found a creature which was something between a goat and a pig in shape. No one was able to give it a name; but he met on the road two youths who said to him: this is called the yün. It devours the brains of the dead underground; but if you pierce its head with pines 松 and cypresses 柏 it will die. For this reason cypresses are planted now upon graves, in order to ward off this danger."

So much for the *wang siang* monster and the practice of planting cypresses in the neighbourhood of tombs,—one of the many usages in which the ancient Chinese are seen to have been impressed with the same ideas in relation to their burial customs as were

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(*) 翁仲. The *P'ei Wên Yün Fu* (Book 61) gives the following explanation of this term: "In the history of the Wei dynasty, the annotation to the reign of Ming Ti states that in the first year of the reign King Ch'u (A. D. 237), a great supply of copper was given out, wherewith two statues were cast, which were named *Wêng Chung*. They were seated without the Sze-ma gateway of the palace."

(†) *P'ei Wên Yün Fu*, Book 52.

(‡) Cf. *Shuh I Ki*, Book II, p. 12, in Vol. 35 of the *Han Wei Ts'ung Shu*. The passage as printed in this place is slightly different from that quoted, as from the *Shuh I Ki*, in the *She Lui Fu* 事類賦, book 25, art 柏, but the variation is unimportant. It consists principally in the addition of the words rendered above as: "no one was able to give it a name," in place of the words "Muh Kung," which stand by themselves in the other text.

entertained by the nations of the West. The *fang siang she* who are found mentioned in connection with this monster, in the passage cited by Wu Yung-Kwang as above quoted, were functionaries who, according to the Chow Li 周禮, or Official Ritual of the Chow dynasty (Book 31), were specially charged with the duty of exorcising evil influences from dwelling houses and tombs. Biot (*Le Tchéou Li*, Paris, 1851, Vol. II, p. 225), translates the passage in question as follows:—"Lorsqu'il y a un grand service funèbre, il précède le cercueil jusqu'à la tombe. Quand on entre le corps dans le caveau, il frappe les quatre angles avec la lance. Il chasse le *Mang liang*." (*)

From the extract assigned to the *Fêng Suh T'ung*, as quoted by Wu Yung-kwang, it would appear that in times posterior to the Chow dynasty, an image of the exorcist or *fang siang* was erected by the side of the tomb, from whence it would seem the inference is left to be drawn, the practice arose of placing figures such as those called *wêng chung* (the images of warriors and civilian functionaries) in the same position. Something remains to be said, farther on, with reference to these statues of human beings; but before proceeding to the second portion of the present enquiry, the meaning probably attributable to some of the other figures placed at the approaches to tombs may be briefly touched upon.

As has already been noted above, the cypress tree and the tiger were believed at a very early period to exercise a special power of guardianship against the attacks of goblins or ghoul-like monsters upon the remains of the buried dead; and these are the earliest among the objects which are recorded as having been planted or represented in the neighbourhood of tombs. We find them in company there at the present day, and with them the traces also of other creatures believed to be invested with supernatural powers. The monumental tablets erected in honour of a deceased person are crowned, as has been seen above, in some cases by the head of the *li* or "harmless dragon," and in others by that of the *Ki-lin*, or beast of happy omen. For personages of a still lower degree—the third grade of official rank—the regulations provide

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* 罔兩—*Mang-liang* or *Wang-liang*, a name in which an obvious relationship with the *Wang-siang* may be noticed. The more orthodox way of writing this name, however, is *Fang-liang* 方良, as is seen in accepted editions of the Thirteen Classics. In K'ang Hi's dictionary the term *Fang-liang*, as above, is defined as synonymous with *Wang-liang* 罔兩, and this expression is explained as signifying "a goblin or sprite of the woods and rocks." The explanation, quoted in the same place, of Chang Hêng's poem entitled *Tung King Fu*, (2nd century A.D.), gives the meaning of *fang-liang* as "a spirit of the lakes and meadows."

that the crowning border is to represent the *t'ien luh* 天祿 and the *pih-sieh* 辟邪. These two fabulous creatures, the meaning of whose names, translated literally, is "the good fortune of Heaven" and "a charm against evil," were anciently represented in full effigy, according to the authorities quoted by Wu Yung-kwang, in front of tombs. The notes in explanation of the *Si Yih Chwan* 西域傳 or Description of the countries of Central Asia, forming part of the History of the Han dynasty, are cited as defining the *t'ien luh* as an animal like a deer, (*) but with only one horn, and the *pih-sieh* as having, on the contrary, two horns. The *Tsih Ku Luh* 集古錄, by the celebrated historian Ngow-yang Siu, (A.D. 1017—1072), and two other ancient works, are quoted as mentioning these beasts, the *Tsih Ku Luh* stating, in particular, that their effigies, carved in stone, were set up in front of the tomb of Tsung Tsze 宗資 of the Han dynasty. At the present day, the name *t'ien luh* is given to the small couchant figures of nondescript animals which crown the *wang chu* or monumental pillars forming part of the array on either side of the pathway leading to the tomb. The *wang chu* themselves are considered as the tokens by which the spirit, when wandering (†) from its earthly resting-place, finds its way back again to the tomb.

It might be possible, were the subject more akin to the subject of the present enquiry, to trace to these conceptions, prevalent, as we see, among the early Chinese, the origin, in part at least, of the heraldic blazons of griffins, unicorns, and other more or less fabulous animals which found their way into Europe, it is believed, among the results of the Crusades. Leaving, however, this attractive subject on one side, we may pass on to examine the data which Chinese literature affords with reference to the period at which imperial or other tombs may be considered to have first been placed under the tutelage of the stone figures to which the present paper relates.

Owing, probably, to the fact that no classic author has found occasion to make special mention of this practice and that, for this reason, allusions to it have not been considered admissible in verse making and the composition of elegant essays, the ordinary works of reference contain little information on the subject. The

* The substitution of 祿 *luh*, good fortune, for 鹿 *luh*, a deer is a well-known play upon sound in Chinese usage.

† The same idea is connected apparently with the pillars which adorn the court yard in front of the main gateway of the palace city at Peking. The animal figures by which these are crowned are popularly designated *Wang Kun Kwei* 望君歸, i.e. "watching for the sovereign's return." They are supposed to guard the palace during the emperor's absence.

most explicit passage relating to it which the writer has met with, of comparatively ancient, date, is contained in Ma Twan-lin's *Wên Hien T'ung K'ao*, (Book 125). This is sufficiently noteworthy and interesting to merit translation in full. It is as follows:—

"T'ai Tsu, the founder of the Posterior Chow dynasty, (*) was buried at the Sung Ling 嵩 陵. In times before his death he had repeatedly admonished [his adoptive son and successor] the Prince of Tsin, saying to him: When I was advancing at the head of my army toward the West, I saw the eighteen imperial tombs of the T'ang dynasty, every one of them broken open and despoiled. The only reason for this was the great treasure they contained in gold and gems. When I am dead, do thou wrap me in paper grave-clothes, and enclose my body in an earthern coffin. Use no stone to line the vault, but only brick. Let all the artificers and the people stationed near my tomb be employed of their own free will: let no oppression befall the people for this matter. When the burial is completed, let thirty householders, of those who dwell near the tomb, be engaged to watch over it, with exemption granted them from all other forms of State service. Build no mausoleum over the tomb, nor allot any of the inmates of the palace to dwell beside it, and set up no stone figures of goats, tigers, human beings, and horses. Let there be only a stone placed in front of the grave-mound, with an inscription declaring that 'the Son of Heaven, Chow, in his lifetime loved frugality and moderation, and, dying, commanded that his grave clothes be of paper and his coffin be of baked earth. His successors will not venture to depart from this rule! If thou depart from it, my son, I will send no blessing unto thee."

From the foregoing passage it is clear that in the middle of the 10th century of our era the practice of placing stone figures, as at the present day, in front of tombs, was known and reprobrated as a needless pomp; and from what has been handed down respecting the gorgeous style of decoration introduced by the emperors of the T'ang dynasty for the surroundings of their tombs, it is more than likely that the avenues of figures which She Tsu of the Chow dynasty is shewn above to have forbidden in his own case were included among the appurtenances of the imperial mausolea of the 8th and 9th centuries. The special reverence displayed for ancestral places of sepulture, and the custom of visiting and decorating the restingplaces of the dead in particular, are known to have received their first legitimation in the reign of Hüan Tsung of the

* Named Chow Kwoh-wei,—died A.D. 953.

dynasty above-mentioned. In the 20th year of the reign K'ai-yüan (A.D. 732), it is recorded, (*) the festival of the tombs at the *Tsing Ming* 清 明 period (the beginning of April), now universally celebrated throughout China, was for the first time enrolled among the ordinances of State; and acknowledgment was made at the same time that the usage did not ascend beyond the period of the Ts'in and Han dynasties, some 800 or 900 years earlier. All indications point, in fact, to the rulers of the Ts'in dynasty as the introducers of a style of funeral magnificence unknown to earlier Chinese tradition, and mingled with practices of immolation which came near to taking root among the imperial ordinances of the State. To this rite of sacrifice of domestic animals, among other "accompaniments of death"—*ts'ung sze* 從 死—we may probably attribute the appearance in later times of the effigies of such creatures beside the sepulchral avenue.

The most striking historical instance of the sacrifice of living creatures, other than human beings, at the obsequies of the imperial dead, is preserved in a passage to be found in the work of more than one author, and derived by all, most probably, from the History of the Han dynasty. Ma Yung-K'ing, in his *Lan Chên Tsze*, (†) observes that:

"In the time of the Han dynasty, the practices connected with the rites of interment were lavish in the extreme. When the obsequies of the emperor Wu Ti took place (i.e. in B.C. 86), his successor, Chao Ti, being still of tender age, the Regent Hoh Kwang, regardless of proper teachings, took coins of gold and other treasures, birds, beasts, fishes, tortoises, oxen, horses, tigers, and leopards, in all one hundred and ninety living creatures; the whole of which he caused to be slaughtered and buried at the same time. He also compelled the inmates of the deceased emperor's seraglio to constitute themselves the attendants destined to reside at the sepulchral park 守 園 陵; and hence arose the custom of having 'concubines of the mausoleum,' 園 妾, which succeeding generations followed without change. Peh Kü-yih (A.D. 772—846) has among his poems an ode, which cannot be read without a sense of sadness, entitled *Yüan Ling Ts'ieh* 園 陵 妾 or 'the consorts of the tomb'."

The lavish magnificence affected on the occasion described above

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* Cf *Yüen Kien Lui Han* 淵 鑑 類 函, Book 171, 上 陵.

† 嬾 眞 子, by 馬 永 卿, an author of the first half of the 12th century. His Collectanea, under the above title, from Vol. 39 of the *Pai Hai* 稗 海 collection of reprints. See Book 4, p. 8.

was, however, but a feeble copy of that which attended the funeral of She Hwang-ti, the founder of the Chinese imperial system toward the close of the third century before Christ; and it is to his remote progenitors (if indeed, in his case, the illegitimacy of his birth being considered, that expression be allowable), the early princes or *Kung* of Ts'in, that the practice of immolating sacrifices at the interment of the dead is historically traceable. Among the few incidents of the early history of this remote western principality which Sze-ma Ts'ien, the renowned chronicler of the second century before the Christian era, has handed down in his invaluable work, it is recorded that (in the year B. C. 678) "on the death of Wu Kung 武公, in the 20th year of his reign, he was buried at P'ing-yang in the region of Yung; and then, for the first time, human beings shared the fate of the deceased sovereign. The number of those who accompanied him in death was sixty-six." (*) Such is the laconic record which stands out in history with reference to this occurrence; but it will be noticed that explicit mention is made of the fact that the sacrifice of human victims, and this apparently of a voluntary nature, took place for the first time on the occasion described. The next instance to be adverted to is conspicuous as the subject of one of the "ballads of Ts'in" in the Book of Odes. In the year B.C. 659 a grandson of Wu Kung ascended the throne of Ts'in, and became famous in history under the title of Muh Kung 穆公. At his death (in B.C. 621), Sze-ma Ts'ien relates, "the number of those who shared his fate was one hundred and seventy seven persons. Three devoted servants of the House of Ts'in, belonging to the family of Tsze Yü 子輿, were of this number. Their names were Yen-sih 奄息, Chung-hang 仲行, and K'ien-hu 鍼虎." To this passage Ying Shao, in his annotations to the History of the Han dynasty, adds the following explanation: "Muh Kung was feasting once with his courtiers, and being drunk with wine addressed them saying: 'In life we share this enjoyment together, and in the sorrow of death we should not be divided.' Yen-sih, Chung-hang, and K'ien-hu agreed in this saying; and when Muh Kung died, they followed him to the tomb." The three self-sacrificing heroes became celebrated as the Three Worthies—San Liang 三良—and their burial-place was pointed out in subsequent ages in the district of Yung in K'i Chow 岐州. Their posthumous fame was doubtless in large measure owing to the

* 塟雍平陽；初以人從死。從死者六十六人。
(Cf. 史記, Book 5).

balled of the *She King* in which their fate is touchingly bewailed. It may be read in Dr. Legge's translation (the She King, *Chinese Classics*, Vol. IV, Part I, Book VI. Ode 6). The note appended by the translator to this ode erroneously attributes the first introduction of the practice of sacrificing human victimes to duke Ching, or Ch'êng Kung, instead of Wu Kung, as stated by Sze-ma Ts'ien. In the ballad, the name given by the historian as Tsze Yü, is written Tsze Kü 子車.

One more instance, but this the most celebrated and the most circumstantially narrated, of all in connection with the practice of human immolation by the sovereigns of the Ts'in dyuasty, remains to be dealt with. On the death of the mighty conqueror She Hwang-ti, in B.C. 210, his son and successor caused, it is related, his interment to be effected in a great cavern artificially hollowed out in the depths of the Li Shan 驪山 (situated in the modern Lin-t'ung district in Shensi), which She Hwang-ti had prepared during his lifetime as the resting place of his remains. According to the record preserved by Sze-ma Ts'ien, an army of more than 70,000 labourers, gathered from all parts of the Empire, was employed in excavating the bowels of the earth at this spot, down to "three fold depths;" and in the heart of the cavern thus formed "palatial edifices were constructed, with positions duly allotted to each rank of the official hierarchy, and these buildings were filled with marvellous inventions and rare treasures of every kind. Artificers were set to work to construct arbalists ready strung, with arrows so set that they would be shot off and would transfix any one who should penetrate within their reach. Rivers, lakes, and seas were imitated by means of quicksilver, caused to flow by mechanism in constant circulation. Above, the configuration of the heavens, and below, the outline of the countries of the earth, were depicted. Lights were made with the fat of the man-fish, (*) with the design of keeping them continually burning. Urh She (the young Emperor) said: It behoves not that those of my father's female consorts who have borne no children should go forth into the world; and he required of them, hereupon, that they should follow the dead Emperor to the tomb. The number of those who consequently went to death was very great. When the remains had been placed beneath ground, it chanced that some one said: The artificers who have made the enginery know all that has been done, and the secret of the treasure will be noised abroad. When the great ceremony was over, the central gate of the avenue of approach having already been closed, the lower gate was shut, and

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* See below.

the artificers came out no more. Trees and herbage were planted over the spot, to give it the appearance of [an ordinary] mountain."

Thus far the obscurely worded and, in many respects, unmistakeably fabulous account which is given by the Father of History with regard to the tomb of She Hwang-ti. The commentators upon his work have expressed such widely differing opinions with reference to more than one of the passages it contains that the subject is best left in its visible uncertainty. The "Man-fish," which is spoken of as supplying the oil whence lamps were fed, with the object of securing a perpetual illumination, is defined by Sü Kwang, the renowned editor of the 4th century, as "a fish resembling the *Nien* 鮎, with four legs. This explanation, however, which is probably based upon a resemblance in sound between the character *Nien* and that of 人 (*jen* or *nyen*,—man), employed in the text of Sze-ma Ts'ien, leaves the passage shrouded in no less darkness than before; and the point is not of sufficient consequence to be worth pursuing farther.

What has appeared of most importance to the writer is the reproduction here, in connection with the practice of erecting stone figures at the tombs of deceased great personages, the three authentic passages which are to be found in Chinese history respecting the immolation of human victims in connection with funeral rites. (*) It will be seen that, whatever may be thought of the prehistoric origin of the rulers and population of the State of Ts'in, and close as their proximity unquestionably was to the territories of the Hiung-nu and other Central Asiatic nations, the records that have come down to us confer little warranty upon the assumption that the practice of causing human attendants to share the fate of the deceased was necessarily derived from an external source. The expression placed in the mouth of Duke Muh, on the contrary, seems more closely allied to traditional Chinese notions respecting the bonds of loyalty and friendship than to the more primitive ideas to which, among nations such as the Hiung-

* The only remaining instance of human sacrifices in connection with funeral rites that the writer has met with in Chinese literature is a passage in the *Wu Yueh Ch'un Ts'iu* 吳越春秋, a well-known ancient work, in which it is recorded that Ho-lü Wang, the Prince of Wu, who reigned from 514 to 496 B.C., having lost a favourite daughter, prepared for her a magnificent Tomb without the Ch'ang gateway of his capital, (the modern Soochow), and sacrificed, to "accompany her in death," a large number of men and women, together with a white stork, which had been used to inveigle the crowd of sightseers to advance into the tomb. The act, it is added, was reprobated by his subjects. Cf. *Yuan Kien Lui Han*, Book 181, p. 5.

nu or their ancestors and successors, (*) the practice of human sacrifice is to be attributed. That a certain substratum of fact, in the shape of lavish preparations for an interment adequate to a conqueror's renown underlies the tradition preserved by Sze-ma Ts'ien respecting the burial of She Hwang-ti, is in itself essentially probable; and the celebrity of his tomb is vouched for by the numerous legends concerning it which are to be found in writings of the centuries immediately following his decease. In little more than a hundred years after the death of She Hwang-ti, the intercourse between China under the House of Han, and the nations of Central Asia, had become frequent and intimate; and it is reasonable to ascribe to the introduction at this period of alien ideas the magnificence with which, according to the passage already quoted above, the obsequies of Wu Ti were conducted in B. C. 86, and the sacrifice which then took place of a multitude of animal victims. There may be room for the belief, moreover, that with the practice, seen to have been followed at least on the occasion described, of honouring the obsequies of the dead with prodigious animal sacrifices, a portion of the symbolism connected with the stone images set up at tombs is to be identified. It has been shewn above that the placing of effigies of "goats, tigers, human beings, and horses," beside the sepulchral approach, is explicitly mentioned in a historical document, with reference to a period not earlier than the middle of the 10th century, and that, in all probability, the mausolea of the T'ang dynasty, two or three hundred years before this date, were decorated in this manner. The quotation from the work entitled *Chih Kuh Tsze*, indeed, which has already been embodied above, declares that since the times of the Ts'in and the Han dynasties, such effigies had been

* In this connection, the following incidents, which the writer has found recorded in a work of the Sung dynasty, may be thought worth citing. Chao Yen-wei 趙彥衞, in his collectanea entitled *Yun Li Man Ch'ao* 雲麓漫抄, (book 1), dating from the latter half of the 12th century, when describing the siege of Tang-t'u (in T'ai-ping Fu in the present province of Ngan-hwei) by the Kin invaders, in A. D. 1130 and 1131 (the author's father having been employed in fortifying the city during the previous year), states that the enemy, irritated at the long resistance of the beleaguered garrison, after slaughtering thousands of the country people whom they had made prisoners, drove 12 pregnant women to the foot of the walls, and there, after ripping them open, devoured the unborn infants. Shortly afterwards, when the Chinese had set fire to the besiegers' works, and were favoured by a strong easterly wind, the enemy chose out from among the prisoners in their hands some of the most stalwart and unblemished individuals, whom they arrayed in gorgeous attire and then, driving them to the bank of the river, ripped open their bodies and tore out their hearts to offer them in sacrifice for a change of wind.

in use; and the comment made by Wu Yung-kwang upon this passage admits the validity of the assertion. As the author quoted from observes, the stone figures of human attendants and domestic animals may be regarded as obviously symbolical of the train of servitors during life; whilst the guardianship of the tomb from unseen influences of a malign nature is committed to the effigies of tigers and other creatures endowed with supernatural powers. The influence of Buddhism, since its introduction into China, whilst it would operate as an effectual check against the slaughter of living beings to swell the magnificence of an Imperial funeral, would doubtless, by the image-worship it entailed, lend increased significance to the guardian figures placed sentinel-wise before the tomb; and it was probably to Buddhistic teachings that the statues or *wêng chung* mentioned as having been erected in A.D. 237 outside the gateway of an imperial palace owed their origin. As a general conclusion, it may be observed that the avenues of stone figures, to an elucidation of the significance of which the present paper has been devoted, are connected primarily with the ancient Chinese superstitions relating to invisible powers of evil and the means of controlling them,—in fact, with fetish worship—and secondarily with the honours paid to deceased great personages in the sacrifice of domestic animals to attend them in the world of shadows.

ARTICLE II.

THE COMPARATIVE STUDY OF CHINESE DIALECTS.

(By E. H. Parker, Esq.)

H. B. M.'s Consular Service.

WITHOUT disparaging the excellent and careful labours of many industrious men, it is not too much to say that the study of colloquial, as distinct from literary Chinese is still in its infancy. If the only object in learning a spoken language is to make ourselves understood by hook or by crook to persons speaking a different tongue from our own, there is no reason why the barbarous lingo called "pidgin" English should not be cultivated as assiduously as Chinese. What is the object of an Englishman in learning to speak French? It is not to scramble through a number of sentences, regardless of genders, numbers, and cases; ignoring all inflection and accentuation; but, to speak the language as nearly as possible as do the natives of France themselves. Every one knows what social distinction the faculty of speaking any European language correctly and elegantly confers upon foreigners dwelling in a European capital. The Frenchman who says "zees is ze ouse of my fazzère" is quite as comprehensible as the one who says, "This is the house of my father"; yet few would maintain that it was a matter of indifference which style was adopted by a French Ambassador accredited to the court of St. James. With the unfortunate Chinese language, however, it is different: the majority of foreigners speaking *kwan-hwa,* or any other dialect, speak, especially in the case of *kwan-hwa,* nothing more than a *lingua franca,* either a mixture of several dialects, or a more or less approximate imitation of some one dialect. There is nothing at all objectionable in this as long as it is frankly confessed, and as long as the speaker does not lay claim to anything further than he is entitled to. But this is not the case: such speakers, finding that

they can in most instances make themselves fairly understood, wherever they go, especially amongst Chinese officials, at once assume that they can speak the language perfectly correctly, and that all painstaking and accurate study is a mistake, or at least a waste of time. The fact that, even amongst Chinese scholars of reputation, men can be found who declare the tones to be a myth, the aspirates to be useless; and so on, is sufficient of itself to prove that the general knowledge of colloquial Chinese is as yet very superficial. After a few days' practice it would be possible to converse with perfect fluency and clearness in German, having mentally abolished the genders, the declensions, conjugations, members, and cases; in fact having done away with all inflection whatsoever. The fact again that "pidgin" English may be acquired in a few days demonstrates how comprehensible English may be made when not only are all inflections abolished, but hundreds of words distorted, in addition, from their original meaning, and the formation of whole sentences inverted. What would be thought of an Englishman who, having picked up a current knowledge of Platt-Deutsch, with which, of course, he could make very fair headway amongst all intelligent Germans, took up the position that the complicated grammar of high German, and the confusing vowels of the Dutch were a mistake and a waste of time, and that the true course for a foreigner was to acquire a current knowledge of Platt-Deutsch?

By all means let those who do not wish to enter minutely into the genius of the colloquial Chinese dialects adopt a *lingua franca*, which is undoubtedly easy to acquire, and extremely useful for all every day purposes; but let them at the same time frankly admit that they are not within the pale of scientific and accurate knowledge; and let them not mislead and discourage beginners by denouncing as useless the accuracy which they have been unwilling or unable to acquire.

What a hopeless task to attempt to gain an accurate pronunciation from the volumes of Morrison! Tones are ignored throughout and aspirates also in many places: moreover the sounds do not represent those of any dialect in the Empire. Yet Morrison's was a stupendous work, and any refinement upon it at the time would have been treated, probably, as supererogatory labour. Many years afterwards came Dr. Williams' Tonic Dictionary, abounding in improvements upon Morrison's crude work, and so carefully prepared that the living Cantonese dialect could be learnt very passably from that alone. After this appeared Mr. Wade's *Tsz-erh-chi* in the Pekingese dialect, which to this day is the only text-book which actually presents a dialect as it is, regardless of

standards which exist *in nubibus*; ignoring initials. tones, aspirates and finals, which ought to be but are not; and confining itself strictly to representing a dialect as it positively is, in a given place at a given time. By so to speak, nailing his colours to the mast, and fixing the attention of Students to one living standard the auther has done more to advance the correct speaking of Chinese than all the dictionaries and text books put together. Besides these two works, Messrs. Baldwin and Maclay's Dictionary of the Foochow dialect collects with faithful accuracy an astonishing number of the every day expressions in that language; and much the same is stated by those who are conversant with the Amoy dialect to have been done by the Revd. Carstairs Douglas.

The study of character may be pursued with great advantage with the help of any of the above mentioned dictionaries and text-books, but the accurate study of the colloquial dialects has yet to follow. To begin with the Pekingese,—there is no satisfactory dictionary as yet in existence. Mr. Wade's course, though wonderfully accurate and complete as far as it goes, only presents a very small fraction of the rich colloquial of Peking and the neighbourhood: besides, there are one or two grave defects, such as the confusion into one vowel of the two vowel-sounds represented by the characters *kwang* "bright," and *sang*, "dead"; and the needless separation of the identical vowels represented in the words *chih* and *tzŭ*, *shih* and *ssŭ*. In Dr. Williams's dictionary, again, several classes of vowels existing in theory, according to the standard *in nubibus*, encumber the work, when one vowel would have stood in each case for them all. One of the nine regular tones, too, is entirely ignored: and the whole class of colloquial tones called the *pín yam*, which form so striking an element of quasi-inflection in the pure Cantonese dialect, has been completely overlooked. Dr. Eitel, in his corrected edition of the Tonic Dictionary, has introduced the ninth regular tone, but he likewise, instead of adhering steadfastly, (as did Mr. Wade in the case of the Metropolitan Pekingese,) to the Metropolitan Cantonese, has, by overlooking these colloquial tones, once more lost the opportunity of firmly establishing another standard dialect. In the Foochow dictionary Mr. Baldwin has, in his preface, given but a very meagre idea of the nature of the all-pervading vowel and tone inflection so strikingly exemplified in that dialect, though, as a faithful index to a living language, that work stands far ahead of the Canton Dictionaries. The writer is unable to say what has been done in the Amoy Dialect, for no comparative opinion which is not based upon an intimate personal acquaintance with a dialect is of any scientific value. Nothing worth mentioning seems to have been done for the

dialects of Tientsin, Chefoo, Shanghai, Ningpo, Wênchow, Kiukiang, Swatow, Hankow, or Chinkiang.

Before going afield amongst the Sanscrit, Mongolian and other languages for philological comparisons, would it not be better to first of all master the Chinese dialects, and endeavour to discover in what lines the laws of changes seem to run?

The real points of interest in the comparison of dialects are two: the regular and systematic changes which words represented by characters have undergone in each dialect; and the characterless words which are to be found in each.

The following tables give lists of characterless words in Pekingese, not existing in any dictionary or hand-book; characterless words in the Hankow dialect, for which there seems to have been, as yet, no dictionary or hand-book published; characterless words in Cantonese, not found in the Cantonese dictionaries, nor in vocabularies published by foreigners; and characterless words in the Foochow dialect not found in the Foochow dictionary. In addition to these, a short table indicates the principle on which these may be compared one with the other: another table exhibits the relative sounds of tones, which are nominally similar either in a pure or qualified sense, in all dialects. Finally a table of spelling shews the inconveniences attaching to the practice, followed by all text-book and dictionary makers, of inventing a new alphabet to represent the vowels of each dialect.

An immense quality of *pabulum* for future digestion might be collected if residents at particular spots would acquaint themselves with the dialects of such spots, noting first the systematic changes forming the regular character-words, and secondly the vulgar colloquialisms not represented by character. No more speedy or interesting way of doing this can be found, perhaps, than by taking Mr. Wade's colloquial course, and getting a pure native to render an exercise daily into his own local dialect, carefully excluding all that is not purely and locally colloquial.

THINGS NOT GENERALLY KNOWN IN PEKINGESE.

Students of the Mandarin Dialects, especially the Pekingese, are often under the impression that this language is, having regard to the written character, comparatively pure when contrasted with the less aristocratic dialects of the South, and that it is not encumbered with many unauthorised or characterless words. The

accompanying list of words, which are culled from memory, and the results of a short two years' experience in the metropolis, may contribute in some small degree to do away with that idea. Residents in the capital will do good service if they can succeed in fixing reasonably probable characters to any of them; and still better service if they will make notes of and publish similar lists of such waifs and strays of language as may fall under their ken. For some years the writer has not had the advantage of much conversation with genuine Pekingese, and, in consequence, a small minority of the examples given are marked with an asterisk, as indicating some slight uncertainty as to the precise sound or tone. All words of which the tones are unmarked, are either enclitics, or, in ordinary conversation, toneless for practical purposes. He would take this opportunity of warning readers not to accept as Pekingese the local colloquialisms of Manchu garrisons at Chinkiang, Canton, Foochow, and other places, or the *dicta* of "Southern Mandarin" teachers. A very large number of unauthorised and quasi-characterless words are given in Sir Thomas Wade's Colloquial Series; and enquiring students must in all cases be prepared to convince themselves that many of these really valuable words are embodied in characters quite new, or at all events uncertain, to the majority of Pekingese themselves. He would also ask students to reflect how few Englishmen commend themselves as satisfactory referees upon strange and uncertain words, and beg them not to take it for granted that every Chinese is a walking dictionary, or a philological antiquarian. Each fact requires *worming* out, and demands the *consensus* of several persons before it becomes of any lexicographical value.

1. *A* 3; *Kung* 3-*a* 3-'*rh*; a quartett, or trick at cards.
2. *Ai'* 4 *Hang* 4 or *ai'* 4-*hao* 4; a target; probably a *Manchu* word.
3. *Cha* 1: *Cha* 1-*la* 3 '*rh*: a station-house; probably a *Manchu* word: (not to be confused with *Cha* 4-*la* 2 '*rh*.)
4. *Cha* 3; *Shui* 3-*cha* 3; the unusual northern name for snipe: *Cha* 3-*tsz*, slack, or loose coal.
5. *Ch'a* 2; *Chau* 3-*ch'a* 2-'*rh*, to find fault with unnecessarily.
6. *Ch'a* 3; flat, as a plate, in contradistinction to deep; *Ch'a* 3 *k'ou* 3, funnel-shaped. To open out. See also *Ch'ua* 3.
7. *Ch'a* 4; *yi* 2-*ch'a* 4-'*rh*; a moment of time.
8. **Ch'ai* 1; to sew, with a running stitch.
9. *Chan* 1; *ko* 1' *cha* 1' '*rh*, a scab.
10. *Chao* 1; to contain; *chao* 1-*pu* 4-*hsia* 4, will not contain.
11. *Ch'ên* 1; *ch'ên* 1-*lien* 4, to browbeat, as a barrister his witnesses; to question.

12. *Ch'ên* ^{1}; to draw out, as elastic.
13. *Ch'êng* ^{1}; *ch'êng* ^{1} *tsz*. a gridiron, a bamboo cooking slat.
14. *Chi* ^{1}; *chi* ^{1}-*liao* ^{3}-*'rh*: the katydid, or "scissors-grinding" *cicada*.
15. *Ch'i* ^{1}; to hem; probably the same as *ch'i* ^{2}, even. Also a slit, as in a gown, or shirt. * To sew with an up and down stitch.
16. *Ch'i* ^{2}; *Ta* ^{4}-*kai* ^{4}-*ch'i* ^{2}, a sketch or outline.
17. *Chiang* ^{3}; *chiang* ^{3}-*tsz*. a hardened price of skin, such as that produced on the hands by rowing.
18. *Chiao* ^{3}; to cut with scissors.
19. *Ch'iao* ^{1}; to geld.
20. *Ch'iao* ^{3}; the male organ; probably the same as *ch'iao* ^{4}, a sheath. *Ch'iao* ^{4}-*ch'u* ^{1}-*lai* ^{2} means to whip the organ out, as a jackass does.
21. *Chieh* ^{3}: *ta* ^{3}-*chieh* ^{2}-*tsz*. to tie a knot; for *chieh* ^{2}.
22. *Ch'ieh* ^{4}; *ch'ie'* ^{4}-*'rh-mao* ^{2}, a shuttlecock. Also read *chien* ^{4}.
23. *Ch'ieh* ^{4}; *ch'ieh* ^{4}-*mao* ^{2}-*tsz*, the scenery of a theatre, or the dresses, &c., probably for *mo* ^{4}, a veil.
24. *Chih* ^{1}; a gridiron; *chih* ^{1}-*tsz*. Probably *chih* ^{1}, to prop up.
25. **Chih* ^{4}; *yen* ^{3}-*chih* ^{4}-*mao* ^{2}, the eye-lashes; probably used for *chieh* ^{4}. Also, *chih* ^{4}-*tsz*, the stone used in exercises, or gymnastics.
26. *Chien* ^{4}; a small hawk. See also *ch'ieh* ^{4}.
27. *Chien* ^{4}; barren; *chien* ^{4} *sui* ^{4}, a bad year; probably one of the numerous forms of a character *ch'ieh* ^{4}. [This character is read *hip* in Cantonese; and *hip sui* means a barren year in that dialect; the same character is frequently read *chien* ^{4} in Pekingese.]
28. *Ch'ien* ^{1}; to peck.
29. *Ch'ien* ^{4}; to drive in, as stakes or piles. Probably *ch'ien* ^{4}, to inlay.
30. *Chu* ^{4}; *chu* ^{4}-*mu* ^{2}-*'rh*, the Mahommedan Sabbath; probably an Arabic word.
31. *Ch'ua* ^{3}; to flounder along in the mud. Also *ch'a* ^{3}.
32. *Chuai* ^{1}; maimed; *chuai* ^{1}-*tsz*, one lame in the arm.
33. *Ch'uan* ^{4}; to grind, as corn.
34. **Ch'üeh* ^{4}; *ta* ^{3} *chueh* ^{4}, chaff, tease, ridicule. Probably for *ch'ü* ^{4}.
35. *Ch'ung* ^{4}; strong, as tea or tobacco.
36. *Ch'ung* ^{4}; *yi* ^{2} *ch'ung* ^{4} *p'ai* ^{2}, a pack of cards.
37. *Ch'ung* ^{4}; *ch'ung* ^{4}-*cho*, towards, facing, running against.
38. *Fa* ^{2}; *fa* ^{2}-*t'iao* ^{2}, the spring of a watch; probably *fa* ^{2}, "a method."

39. *Fei*^{3}; *ta*^{3}*-fei*^{3}*-tsz*, to snap or fillip the fingers.
40. *Ha*^{1}; *Ka*^{1}*-sha*^{1}*-ha*^{1}, slang; a rowdy; probably a *Manchu* word. Also *ka*^{1}*-shih*^{1}*-ha*^{4}.
41. *Ha*^{1}*-la*^{1}; a "surname," a "family name." *Ha*^{1}*-la*^{1}*-wei*^{4}; high smelling, as salt game: both probably *Manchu* or Mongol words.
42. *Hai*^{4}; with; see *han*^{4}.
43. *Han*^{1}; thick and big, as, a stick, a bar, &c.
44. *Han*^{4}; with; Mr. Wade uses the character ho^{2}.
45. *Hang*^{4}: see *Ai*^{4}.
46. *Hao*^{4}: see *Ai*^{4}.
47. *Hou*^{3}; *t'o*^{1} *hou*^{3}*-hsi*^{4}, punch and judy; probably for *ou*^{3}.
48. *Hsi*^{1}; *hsi*^{1}*-lo*^{4}, to chaff.
49. **Hsi*^{4}; *li*^{2}*-hsi*^{4}, to chaff; probably *hsi*^{4}, to play.
50. *Hsia*^{1}; a "boy," a servant. *A*^{1} *hsia*^{1} a military tent-keeper.
51. *Hsiao*^{2}; *hsiao*^{2}*-li*^{4}, a pick-pocket; probably for *hsiao*^{1} *liu*^{3}, or *hsiao*^{3} *liio*^{4}.
52. *Hsü*^{2}; *hwan*^{2}*-lo-hsü*^{2}, to become a layman again; used for *su*^{2}.
53. *Hsü*^{3}; *hsü*^{3}*-t'u*^{2}, to covet; probably used for *hsi*^{1}.
54. * *Hsüan*^{4}; to pant, as a broken-winded horse. To stuff, as a skin. *T'iao*^{4} * *hsüan*^{4}, to hiccough.
55. *Hsüan*^{4}; *hsüan*^{4}*-tsz*, a bason.
56. *Hsüeh*^{2}; *hsüeh*^{2}*-tsz*, theatrical dresses.
57. *Hu*^{1}; *hu*^{1} *po*^{1} *la*^{3}, a small thrush (?); probably a *Manchu* word.
58. *Hu*^{1}; *ta*^{3} *hu*^{1} *lu*^{1} to snore. Probable *hu*^{1}, to call out.
59. *Huang*^{2}; *so*^{3}*-huang*^{2}, the "female" part of a lock, the bolt or latch.
60. *Huo*^{4}; *t'an*^{2}*-huo*^{4}, palsy; probably for *t'an*^{1} *huan*^{4}. This expression is also used to signify "excess of phlegm"
61. *I*^{4}; *mo*^{2} *i*^{4}; to grind smooth. See *Yü*^{4}.
62. *Ka*^{1}; see *ha*^{1}. *Ka*^{1}*-la*^{1}*-ka-*^{1}*cha'*, dregs, stuffing, padding, rubbish.
63. *Ka*^{1}; *Ka*^{1}*-nueh*^{4}, terse, abrupt.
64. *Kan*^{1}; *Kan*^{1}*-lan*^{2}*cho*, simply, merely; probably *Kan*^{1}, "voluntary." Also, to snub.
65. *Ko*^{1}; *Ko*^{1}*-ti*^{4}*-'rh*; the calyx of a flower. See also *chan*^{1}.
66. *Ko*^{1}; *ko*^{1}*-ko*^{1}, the teats. Perhaps a Tientsin word.
67. *Ko*^{4}; rough, knotty. *Ko*^{4}*-té-huang*^{1}, hard to sit on or lean against.
68. *K'o*^{1}; *k'o*^{1}*-*lo*^{1}*-su*^{4}, Adam's Apple: *t'ou-chên*^{1}*-k'o*^{1}, a stye (on the eye).

69. *K'o* 2; to catch, to get purchase, to be impeded.
70. *Kou* 1; *kuo* 1-*lu-niao* 3, a curlew [philologists, beware!]
71. *K'uo* 4; *lao* 2-*k'uo* 4, firm solid; probably for *ku*, 4 or *k'au* 4.
72. *Ku* 3; *ku* 3-*cho lie* 3'-'*rh*, to look severe; probably *ku* 3, to swell.
73. *Ku* 3; *ku* 3-*tsz*, a target.
74. * *K'u* 4; *wa* 1-*k'u* 4, to browbeat or chaff.
75. *Kung* 3; see *a* 3. To sew with a running stitch.
76. *Kung* 3; to grub with the nose like a pig.
77. *Kwai* 3; eccentric; probably a Tientsin word, or perhaps used for *kuai* 1.
78. *La* 1: *ta* 1-*la* 1, to lick up, as a dog. See also *ka* 1.
79. *La* 2: *la* 2-*tsz*, an bottle; *la* 2-'*rh*, a rock; this latter probably for *lwan* 2 or *lan* 2.
80. *La* 3: *la* 3-**pa* 1, a trumpet: *pan* 4-*la* 3 *yüeh* 4-*liang* 4, half-moon. *P'ang* 2-*pa-la* 3'*rh*, by the side of. * *Mu-la* 3-*mu**-*la* 3, to munch. This last is also read *wu* 1 *la* 3 or *mu* 1 *nien* 1.
81. *La* 4: to omit, drop, &c. The same as *lo* 4.
82. *Lai* 1: *lai* 1-*p'i* 2, a target.
83. *Lao* 2: *hsia* 1 *lao* 2, a mole; an animal which undermines the banks of the *Hwang Ho*.
84. * *Lên* 4: *O* 2-*lên* 4, to run, as ink.
85. *Lêng* 2: *ma* 1-*lêng* 2, a water-gnat
86. *Lêng* 4: owlish.
87. *Li* 2: see *hsi* 4.
88. *Liao* 3: *liao* 3-*tiao* 4, a staple and chain.
89. *Liao* 2: *liao* 2-*tsz*, the male organ, whether of men or animals. See *liao* 4.
90. *Liao* 4: to gather, as seams or stitches. Oftener read *liao* 2.
91. *Lieh* 4: *lieh* 4-*lo-ch'ü* 4, to clear away.
92. *Lien* 2: *wei* 3-*lien* 2, a (winter) cap. *Ta* 2-*lien** 2, a purse, pocket-book.
93. * *Liu* 1: *ti* 1-*liu* 1-*yüan* 2, perfectly round.
94. *Liu* 4: to geld; to creep.
95. *Liung* 2: *liung* 2-*huang* 2, sulphur. For *liu* 2.
96. *Liung* 2: same as the above.
97. * *Lo* 1: see *k'o* 1.
98. * *Lo* 2: see *t'o* 2.
99. * *Lo* 4: *o* 2-*lo* 4 '*rh*, a lark.
100. *Lu* 1: *tu* 1-*lu* 1 '*rh*, a bunch, as of grapes or keys. *Ta* 3 *hu* 1-*lu* 1, to snore.
101. *Ma* 1: *ma* 1-*sa* 1, to pat.
102. *Ma* 2: *ts'ai* 4-*ma* 2 '*rh*, seasoning. Also read *ma* 3.

103. *Ma* ³: *ma* ³-*cho*, in a row. *Mien* ⁴ *ma* ³ *'rh*, seasoning.
104. *Mai* ⁴: to wade. To walk. Probably *mai* ⁴, to progress.
105. *Meh* ⁴: *t'u* ⁴-*meh* ⁴, spittle. For *mo* ⁴ or *mê* ⁴.
106. *Mo* ²: *ts'ao* ³-*mi* ², a miscarriage. Also read
107. *Mieh* ⁴.
108. *Mo* ¹: *mo* ¹-*so* ¹, the same as *ma* ¹-*sa* ¹.
109. *Mo* ²: *yi* ⁴-*mo* ², a meal. Or
110. *Mo* ⁴.
111. *Mu* ¹: see *la* ³.
112. *Na* ⁴; *so* ³-*na* ⁴, a clarinet.
113. *Ni* ⁴: *ni* ⁴-*tsz*, putty.
114. *Nien* ¹: see *la* ³.
115. *Nien* ³: *têng* ¹-*nie* ³-*'rh*, a lamp wick.
116. * *Nueh* ⁴, or *nüo* ⁴; see *ka* ¹. *Chü* ¹ *nieh* ⁴ or *nüeh* ⁴, (for *ni* ²), obstinate.
117. *O* ²: see *lên* ⁴, and *lo* ⁴.
118. *O* ³: *o* ³-*hsin* ¹, sick; nausea. Probably for *o* ⁴.
119. * *Pa* ¹: see *la* ³.
120. *P'ai* ¹: *p'ai* ¹-*tsz*, a flail; a sledge; in the latter case probably for *p'ai* ².
121. *Pan* ¹: to extract, as teeth: probably *pan* ¹, to remove.
122. *Pang* ¹: *lao* ³-*pang* ¹; simple, honest.
123. * *Pên* ¹: **pên* ¹-**to-mu* ⁴, a woodpecker.
124. *Pêng* ³: *pêng* ³-*cho-lien* ³, to look grave or angry.
125. *Pêng* ⁴: to burst.
126. *Pi* ⁴: *pi* ⁴-*pi* ⁴-*shui* ³-*'rh*, to drain or strain off the liquid or water.
127. *Piao* ⁴: *p'iao* ⁴-*lo*; "plucked," as an unsuccessful student.
128. *Pieh* ¹: *ma* ³-*pieh* ¹, a leech: probably *pieh* ¹, a turtle.
129. *Pieh* ²: to pin, as the hair.
130. *Pieh* ³: concave. *Tso* ³-*pieh* ³-*tsz*, left-handed.
131. * *Pieh* ³: *yen* ¹-**pieh* ³-*tsz*; a catch, or ornament worn to keep pipes &c. slipping from the belt. *Quære, pieh* ².
132. *Pien* ¹: *pien* ¹-*tsz*; the female organ of a pig.
133. *Po* ¹ (or *bo* ¹) a tent: *mêng* ³-*ku* ¹-*bo* ¹, a Mongol tent: probably a Thibetan or Mongolian word.
134. *P'o* ⁴: *wen* ¹-*p'o* ⁴, preserved haws; said to be a *Manchu* word.
135. *P'u* ²: *hsiung* ²-*p'u* ²; the bosom.
136. *P'u* ⁴: a dungeon.
137. *Sê* ⁴; to tuck in.
138. *Sha* ¹; to bind or tie, see *sha* ⁴.
139. *Sha* ⁴: to tie; to snip or cut.
140. *Shao* ⁴: to back, (a horse and cart).

141. *Shêng* ^{4}: *shêng* ^{4}*-'rh,* the male organ of an ass.
142. *Shou* ^{4}: towards.
143. *So* ^{3}; *so* ^{3}*-na* ^{4}, see *na* ^{4}.
144. *Su* ^{4}: *chi* ^{1}*-su* ^{4}*-tsz*; a fowl's crop. See also *k'o* ^{1}.
415. *Shu* ^{4}: "to decant."
146. *Sung* ^{1}: a sort of hawk or kite.
147. *T'u* ^{1} *t'a* ^{1}, bald. See *t'ang* ^{1}. *Chun* ^{1}*-tsz* ^{3} *ting* ^{3} *shang* ^{4} *liang* ^{4} *t'a* ^{1} *t'a* ^{1}.
148. *T'a* ^{4}; see *t'i* ^{4}.
149. *Tai* ^{3}: to catch, to trap.
150. * *T'an* ^{4}: *tung* ^{4}*-t'an* ^{4}, to move. Possibly for *t'an* ^{2}.
151. *Tan* ^{4}: *ta* ^{3} *yün* ^{2}*-tan* ^{4}; to manœuvre ropes, as canal boats in meeting.
152. *T'ang* ^{1}: to wade. *T'ang* ^{1} *t'ang* ^{1}, bald. See *t'a* ^{1}.
153. *T'ao* ^{4}: *shan* ^{1}*-t'ao* ^{4}, a valley.
154. *Têng* ^{4}: to clarify, to filter.
155. *T'êng* ^{1}: vague. *Man* ^{4} *t'êng* ^{1}*-t'êng* ^{1}, vague.
156. *T'êng* ^{2}! *t'êng* ^{2}*-lo-ch'ü* ^{4}*-lo,* to clear away.
157. *Ti* ^{1}: see *liu* ^{1}.
158. * *T'i* ^{4}: *han* ^{4}*-t'i* ^{4} *'rh,* a shirt. Also read *t'a* ^{4}.
159. *Tiao* ^{1}: *tiao* ^{1}*-chin* ^{1}*-chiao* ^{4}*-ti*; a Jew.
160. *T'ing* ^{3}: *t'ing* ^{3}*-ta* ^{4}, very big. For *ting* ^{3}.
161. * *To*: see *pen* ^{1}.
162. *T'o* ^{2}: *t'o* ^{2}*-lo* ^{2} *'rh,* a spinning top.
163. *Tou* ^{1}: concave.
164. *Tu* ^{1}: see *lu* ^{1}.
165. *Tsa* ^{1}: *tsa* ^{1}*-shih* ^{2}, firm, secure.
166. *Tsai* ^{1}: to fall down.
167. *Tsai* ^{3}: to catch, to trap; see *tai* ^{3}.
168. *Tsan* ^{3}: to sop up. *Tsan* ^{3}*-kan* ^{1}, to sop dry; also *chan* ^{3}.
169. *Tsang* ^{4}: *tsang* ^{4}*-tsang* ^{4}, to whine. to whimper.
170. *Tsung* ^{1}: *tsung* ^{1}*-'rh*; the male organ of a pig.
171. *Ts'u* ^{4}: *ts'u* ^{4}*-hsin* ^{1}*-ti*; brand-new. Also *ts'u* ^{1}.
172. *Tsuan* ^{1}: *hwang* ^{2}*-tsuan* ^{1}*-yu* ^{2}, salmon.
173. *Tsung* ^{4}: to creep, as a snake.
174. *Ts'z* ^{2}: *ts'z* ^{2}*-shih* ^{2}: solid, full, firm.
175. *Wei* ^{1} *wei* ^{1}*-sai* ^{4}, weak.
176. *Wa* ^{1}: see *k'u* ^{4}.
177. *Wo* ^{1}: *wo* ^{1}*-chi* ^{1}*-tsz* ^{3}*-'rh*; poached eggs. Or *wo* ^{4}.
178. *Wu* ^{3}: *wu* ^{3}*-lo*; high, as game.
179. *Wu* ^{4}: *wu* ^{4}*-tsz*; a mole, or black pimple; a bench, or stool.
180. *Yao* ^{2}: *yao* ^{2}*-tsz*; a brothel; a hawk, or kite.
181. *Yao* ^{4}: *yao* ^{4}*-cho-chin* ^{3}; to stick fast, as in the mud.
182. *Ye* ^{4}: *ye* ^{4} *nao* ^{3}*-ku* ^{3}; the brow.

183. *Yu* 1: *yu* 1-*ch'i* 3-*lai* 2, to lift; *yu* 1-*hui* 2-*lai* 2, to rebound.
184. *Yü* 2: *mai* 4-*yü* 2-*tsz*, rice-chaff. Probably *yu* 2, waste.
185. *Yü* 4: *yü* 4-*lo*; limp, loose, slippery, as a worn lock &c.

NOTE.—Nos. 31, 95, and 105 represent sounds not included in Mr. Wade's Syllabary. There is yet another Pekingese sound not noticed by Mr. Wade—*Chüa*, 嗟, meaning "alas!" This is, not a colloquial, but a literary word; its other forms are correctly given in the Syllabary.

WAIFS AND STRAYS IN THE HANKOW DIALECT.

This dialect is one of the most unsatisfactory to deal with. Unlike the Pekingese, which stagnates in a comparative seclusion, little effected by external influences, the dialect of Hankow is in a transitory state of its own proper motion, and is moreover largely affected by the speech of the numerous traders who congregate at that centre. Hence the greatest care is required not to accept blindly as local colloquialisms the chance importations from other tongues. The following list of characterless words is but small; but, when we come to point out and compare with these the similar vulgarisms of other dialects, they will in many cases prove decidedly interesting. One or two of the missionaries in that neighbourhood have a high reputation amongst the native scholars of the place, and they would render valuable assistance by making careful collections of similar colloquialisms, and communicating them to the public. The spelling adopted is Mr. Wade's Pekingese system, which is easily modified to suit this dialect. The entering tone, though precisely the same in sound as the lower even tone, is marked as No. 5. The tones of enclitics are not given.

1. *Ch'ên* 1: *sa* 3 *ch'ên* 1; saucy, impudent. Properly *Ts'ên* 1.
2. *Ch'ien* 4: to covet.
3. *Hao* 4: to swim.
4. *Hang* 1: thick, bulky.
5. *Hsien* 2: *hsien* 2-*tsz*; a brim.
6. *Hsu* 4: a tassel; probably for *sui* 4.
7. *Hsüan* 4: to geld.
8. *Hua* 2, or *hua* 5: to ford.
9. *Huang* 3: to shake.
10. *Hun* 1: muddy; probably for *hun* 2 or *hun* 4.
11. *Jên* 4: to toss, fling.
12. *Ka* 1: *ka* 1-*luo* 5; abrupt, terse.
13. *Ka* 5: to snip, cut. *Ka* 5-*la* 1; a corner, a recess.

14. *Kan* ¹: *kan* ¹*-lan* ²; difficult; probably a transitory form of *chien* ¹.
15. *Kê* ³: to give: probably a form of *chi* ⁵.
16. *Kên* ³: complete, wholesale.
17. *Kên* ⁴: a wale, or bruise-stripe.
18. *Ko* ⁵: *ko* ⁵*-tsz*; a scab, a pimple.
19. *Kung* ³: to grub with the nose like a pig.
20. *Lai* ¹: dirty. *Lai* ¹*-sai* ¹; slovenly.
21. *Lung* ⁴: *lung* ⁴ *pi* ⁵*-tsz*; nasal.
22. *Mê* ⁴: the reverse of coins; *tsz* ⁴*-mê* ⁴, "heads or tails."
23. *Ma* ¹: *ma* ¹*-sa* ¹; to gloss over, to hide a fault.
24. *Ko* ¹, *kou* ¹; *lien* ¹*-ko* ¹, *ts'ou* ¹*-ko* ¹, to draw lots, to raffle. Probably a form of *chiu* ¹ which, however, is read *kou* ¹ by some.
25. *Ou* ⁴: *ou* ⁴*-jê* ⁵; sultry.
26. *Pieh* ⁴: *tso* ³*-pieh* ⁴*-tsz*; left-handed.
27. *Po* ¹: *po* ¹*-lo* ¹*-kai* ⁴; the knee-cap.
28. *Sa* ¹: see *ma* ¹.
29. *Sa* ⁴: who? what? *Sa* ⁴*-tung* ¹*-hsi* ¹, what is it?
30. *Sao* ², or *shao* ²: *hung* ²*-shao* ², the sweet potato.
31. *Ta* ⁵: *hua* ⁵*-ta* ⁵*-ta* ⁵; to slip down, a slip or fall.
32. *T'ang* ³: to ford.
33. *Tê* ⁵: *tê* ⁵*-lo* ⁵, a spinning-top.
34. *Ten* ⁴: a heap; to throw.
35. *T'ên* ⁴: *ta* ³*-t'ên* ⁴; a hitch, an obstacle.
36. *T'ieh* ⁵; see *yü* ².
37. *T'ien* ³: *pi* ⁵*-t'ien* ³; snot, mucus.
38. *Tou* ⁴: to mend. *Tou* ⁴*-li* ³, inside.
39. *Ts'ang* ¹: *lien* ²*-ts'ang* ¹, a flail.
40. *Ts'ên* ²: to lay down, to place.
41. *Tsou* ⁵: to sprain.
42. *Ts'ou* ⁵; *ts'ou* ⁵,*-hsin* ¹, "brand-new."
43. *Tsz* ¹: to rub. *Tsz* ¹*-liu* ², the katydid, or *cicada*. *Tsz* ¹ *wu* ⁴*-lo*, to smudge.
44. *Ts'z* ¹: *ts'z* ¹*-ts'u* ⁵*-lai*, to project.
45. *Wo* ¹: *fa* ⁵*-wo* ¹; diarrhœa.
46. *Wo* ⁵: *wo* ⁵*-chi* ⁵; a blot. *Wo* ⁵*-ts'o* ⁵, dirty.
47. *Ya* ¹: a child.
48. *Ya* ⁵: *ya* ⁵*-tsz*; a maggot.
49. *Yeh* ⁴: to swallow, probably for *yeh* ⁵.
50. *Yü* ²: *yü-t'ieh* ⁵; finished, done, all. Probably a local use of the word *yü* ²*-t'ieh* ⁵, proper, satisfactory.

FORGOTTEN FACTS IN CANTONESE.

So many local characters and characterless sounds are given in Dr. Williams' Tonic Dictionary that, in comparing these with similar words in the Pekingese, Hankow, and Foochow dialects, it will be necessary to refer readers to the dictionary itself. The special purpose of this paper is to point on to many very valuable Cantonese words which have apparently found no place in any foreign dictionary or vocabulary. When the Cantonese Dialect is here spoken of, the expression is used in its purist sense; and refers or intends to refer to the dialect spoken within the walls of the Provincial Capital. Colloquialisms peculiar to Macao, or to any one township, will be especially referred to where they occur. Students should not allow themselves to be deceived by apparent coincidences in sound, remembering that each dialect follows certain "laws" or rules. For instance, a Pekingese characterless word *pi* 4, which, in the dictionaries, should belong to the entering tone, might find an interesting analogon in a Cantonese word *p'ei*, *pik*,, or *pat*, whilst *pi*, would, on account of its even tone, be an accidental and not a regular dialectical resemblance.

The spelling used is that of Dr. Williams'. The asterisks refer to the *ˏpín ˏyam* or oral *nuances* of tone which neither Dr. Williams nor Dr. Eitel seem to have noticed, and which are explained in the tone table appended.

1. *ˋA*, dirty; *ˋá shik*ˎ , a dirty colour. Probably *ˋá*, "dumb."
2. *A*²; "ten" *ˏsá á*² "thirty." [Dr. Williams gives these as one word *sá*. There is no doubt, however, that the two words are more correct: otherwise a new tone would be required to meet the pronunciation of the sound.]
3. *An*ˊ; "again, another;" *an*ˊ *ˋpí yat, ko*ˊ; "give one more."
4. *Chá*ˊ or *chá*²; "to fry," with much oil.
5. *ˎCh'á*; *ˎch'á-ˎch'á-ˋlá-ˋlá*, "inquisitive," "dirty."
6. *ˋCh'á*; a slit. *ˏShám-ˋch'á*; the "slit or opening" in a shirt or coat tail. See also *ˋk'á*.
7. *Ch'á*ˀ; "squat, big-bottomed," as a jar.
8. *ˎCh'ai*; *ˎch'ai-ˎngai*, "down in the mouth."
9. *ˏCh'ái*; to knead.
10. *ˏCh'am*; "to mix," "to pour out and in again."
11. *ˋCh'ám*; "to blink." *ˋCh'ám-ˤngán*; "to blink, to wink."
12. *ˤCh'ám*; "to pierce;" "to daze."
13. *ˏCháng*; "to owe."
14. *Ch'áng*ˀ; to daze;" *ch'áng*ˀ *ˏfá ˤngán*, "to daze the eyes."
15. *Cháp*₂; "to turn," "to tilt." *Cháp*₂*-chák*ˎ, "to turn over;" *cháp*₂*-chik*ˎ, "to tilt up," as a plate.

16. *Chat*$_{ɔ}$; "to rub in;" also, *wat*$_{ɔ}$-*chat*$_{ɔ}$; "cramped."
17. *꜀Chau*; *꜀lau-꜀chau*, "insignificant-looking," "poor-looking."
18. *'Cháu*; "to bind."
19. *Cháu'*; "to catch," as a cat does.
20. *꜀Ch'áu*; "to butt," as a bull.
21. *꜁Ch'áu*; "crumpled," "wrinkled."
22. *꜂Ch'áu*; *꜂ch'áu-꜀ts'an*; "to twist" as the foot by treading sideways.
23. *꜀Ch'é*; "to throw away."
24. *'Ch'é*; *'ch'é-꜀há*, "to wheeze."
25. *'Ch'eng*; *tsó*² *꜀ch'eng-꜁t'au*, "to prostitute one's wife."
26. *'Ch'eng*; "to awake," evidently for *'sing*.
27. *꜀Ch'i*; *꜁hung ꜀ch'i-꜀ch'i*, "red."
28. *Chik*$_{ɔ}$; see *cháp*$_{2}$.
29. *Ching'*; "to dazzle."
30. *Ching*²; "to remain," "the remainder.', Probably for *shing*².
31. *Chip*$_{o}$; *'tá chip*$_{o}$, "to trip."
32. *Chuk*$_{ɔ}$; "to choke." Lee *tsuk*$_{ɔ}$.
33. *꜀E*; *'tá-꜀sá-꜀é* "to belch."
34. *Fák*$_{o}$; "to dust."
35. *Fat*$_{ɔ}$; "hot."
36. *Fít*$_{ɔ}$; "to rush past."
37. *꜀Hai*; the vagina. *꜀Hai-꜀pai*, "the vagina."
38. *Hak*$_{ɔ}$; the same as *hap*$_{ɔ}$.
39. *'Ham*; *'ham-꜀ts'an*, "to run against."
40. *꜀Hán*; *꜀han hai*²; "is it not so?"
41. *Hap*$_{ɔ}$; *hap*$_{ɔ}$ *꜂ngán fan'*, "sleepy." Probably for *hop*$_{2}$.
42. *꜀Hau*; a final particle, like *꜀hiu*, denoting completion.
43. *꜁Háu*; "salacious," "lustful."
44. *Hé'*; *꜁lé-hé'* [1] "clumsy," "perfunctory."
45. *꜁Hi*; "aunt." Probably a local form of *꜁í* and not pure Cantonese. *Tái*² *꜁hi ꜀ma* "my mother's elder sister."
46. *Híp*$_{ɔ}$; the same as *hap*$_{ɔ}$ and *hat*$_{ɔ}$; "to blink."
47. *Híp*$_{o}$; the leaf of a book. Probably for *íp*$_{2}$.
48. *'Im*; *'siu-'ím*, the "loins." *'Pu 'ím* "to patch."
49. *꜀In*; *꜀In* ngan,² "very tough."
50. *꜁In*; *꜂ngán ꜁ín* * "the eyelids."
51. *꜀Ká*; *꜀ká-꜀lá ꜀sang*, "a Lama priest."
52. *Ká'*; *ká'-shai'*; "handsome," "rich."
53. *'K'á*; "a post-house," see *'ch'á*.
54. *Kái'*; "to cut, as with a paper knife."
55. *꜂K'ái*; "figs" or "slices" as of oranges or pumelos.
56. *Kák*$_{c}$; *kák*$_{c}$-*꜀kai-꜂ngán* "cock-eyed."

57. *꜁K'am ; ꜁k'am ꜃p'a*, "scrambling about."
58. *꜁K'am *;* "eyelid." *꜃Ng'án-꜁k'am * ꜀ts'ing*, "greedy."
59. *꜀Kám ;* to insist. *꜀Kám ꜃k'ü hai꜅*, "it must be."
60. *Kám꜄; kám꜄-ngáng꜅*, "obstinate," "violent."
61. *꜂K'án ; ꜂kán-꜀chong*, "a dressing case."
62. *꜂K'ang ;* see *꜂mang*. Also read *k'ang꜄*.
63. *꜀Kau ;* "the penis." *꜀kao-ts'at꜇*, "the penis."
64. *꜀K'au ; ꜀k'au-꜁p 'ung*, "to tack," "to beat."
65. *꜁K'au ; ꜁lau-꜁k'au*, "rude," "unmannerly."
66. *꜀Káu ; ꜀káu-꜂í*, "an arm-chair."
67. *꜁K'é ;* "to bewitch," "to pollute," as women are supposed to do when their things are not kept properly separate from those of men.
68. *꜁K'eng;* "a brim."
69. *꜀Kí ; ꜀fá-꜀kí*, "a flower bed."
70. *꜂Kí ; ꜃yan-꜀shan-꜂kí*, "pregnant."
71. *Kíp꜆ ;* "gun-caps."
72. *Kíp꜇ ;* "stingy." Probably *Kíp꜇*, "to pinch."
73. *꜂K'iu ; ꜂k'iu-miu꜅*, "cunning," "skilful."
74. *꜃K'iu ; ꜃k'iu-chiu꜅ kéuk꜆*, "the leg bent or doubled up."
75. *Kong꜅ ;* the "claws" of crabs.
76. *꜁K'ong ; ꜁k'ong ꜁p'áu*, "bumptious."
77. *꜁K'ong * ; ꜃ma-꜇long-꜁k'ong **, the green locust (*꜀chung-꜀sz.*)
78. *꜀Kú; ꜀kú-꜀ló*, "to stammer." See also *꜀náu*.
79. *꜀K'ü (꜀k'ö)*; see *꜁lü*.
80. *꜁K'ü; (꜁k'ö)* "lame;" *꜁k'ü-꜂shan*, "maimed."
81. *K'üi꜄; k'üi꜄-kai꜄*, "to count up."
82. *Kuk꜇; ngáng꜅-kuk꜇-kuk꜇*, "rustling."
83. *꜂Kung*; "to stand on end" as the hair; "to burrow," as pigs; in this last sense, also *kung꜄*.
84. *Kung꜄*; see *꜂kung*.
85. *꜀K'ung*; "a bunch," as of grapes, or keys.
86. *Küt꜆*; "thick," not watery.
87. *꜂Kwái*; *꜁mun-꜂kwai* "a hinge." *꜀Shü-꜂kwai*, "title-page."
88. *꜃K'wái*; "naughty," "disobedient."
89. *꜀Kwang*; *sho-꜀lung-꜀kwang* (or *꜀k'wang*); "coarse," "loose-woven," "not close texture."
90. *꜀Kwé* [a sound not found in Williams]; *꜀kwé-li-꜀ku-꜀lu*, "mysterious," "ghost-like."
91. *꜂Kwo*; *꜁p'ing-꜂kwo*, "we are quits!." Probably the verb *kwo꜄*, "to pass over."
92. *꜂Lá*; *꜁ch'á-꜁ch'á-꜂lá-꜂lá*, "inquisitive."
93. *꜂Lái*; "to lap up," as a dog or cat.
94. *Lái꜅*; *lái꜅-niu꜅*, "to make water upon," as from fear.

95. ꜀*Lam*; the reverse of *t'át*꜀; "small mouthed," as jars.
96. ꜁*Lan*; ꜁*p'un*-꜁*lan*, "hurriedly."
97. ꜀*Lang*; se ꜀*kwang*.
98. ꜀*Lán*; "to run," as ink.
99. ꜁*Lán*; ꜀*pín*-꜁*lán* "the edge."
100. *Lán*²; "mud," "muddy."
101. ꜀*Láng*; *hám*ᵓ-꜁*yé*-꜀*láng*, "an auction."
102. *Láp*₂; *tái*²-*láp*₂, "fussy," "restless."
103. ꜅*Lau*; "a groove."
104. ꜁*Lé*; ꜁*lé*-*hé*ᵓ, "clumsy."
105. *Leng*²; "a strip" as of land.
106. ꜀*Lí*; see ꜀*kwé*. Also, ꜀*o*-꜀*lí*, "shabby," "stingy."
107. ꜂*Lím*; ꜂*lím*-꜂*tsui*, "to lick the lips."
108. ꜀*Liu*; ꜀*liu*-꜀*ko*, "the minah," or black grackle.
109. ꜀*Ló*; "that;" ꜀*ló*-꜀*pín*, "that side." ꜂*Fo*-꜀*ló*, "soot." *Wok*₂-꜀*ló*, "pan-crust."
110. *Ló*²; "to cool" by ladling in and out.
111. *Lom*²; *lom*²-*lom*²-꜁*sheng*, "the noise of the wind."
112. ꜂*Long*; ꜂*long* ꜂*hau*, "to rinse the mouth."
113. ꜀*Lü* (꜀*lö*); *shik*₂-꜁*yan* ꜀*lü*-*kwat*, "a loafer." "to squeeze."
114. ꜁*Lü* (꜁*lö*); "smoky," "a burnt taste."
115. *Lü*² (*lö*²); ꜁*k'ü*-꜁*lü*† "in confusion."
116. *Luk*ᵓ; ꜀*fa* ꜀*fa* *luk*ᵓ*luk*ᵓ "ornamented."
117. *Luk*₂; "to scald," "a pig-stye," (also ꜁*lung*).
118. ꜅*Má*; ꜂*kwai*-꜅*ma*, "cunning."
119. ꜀*Mai*; "to nip, or pinch" with the nail.
120. ꜁*Man*; ꜁*man*-꜂*kü*, "a bugle."
121. ꜁*Mang**; "stopped," as the nose.
122. ꜂*Mang*; ꜂*mang*-꜂*k'ang*, "disagreeable,"(also *mang*ᵓ).
123. *Mau*²; ꜅*t'am* *mau*²-*mau*² "insipid."
124. ꜅*Máu*; "the buttocks;" ꜀*mo* ꜁*yan* ꜅*máu*, "to get over one."
125. ꜁*Mé**; ꜀*ch'é*-꜁*mé**, "a spinning-top."
126. ꜀*Meng*; "to paste up," as window chinks.
127. ꜂*Miu*; "to purse up" the lips, "to pout."
128. ꜂*Múi*; "to munch." ꜂*Múi*-꜅*ha* ꜂*tsui*, "to move the mouth" like a toothless old man.
129. *Mút*ᵓ; "to pout." *Mút*ᵓ-꜁*mái* ꜂*tsui*-₂*shun*, "to sign with the lips," "to pout."
130. ꜂*Ná*; "biting." ꜂*Ná-chü*² ꜁*t'iu-lí*ᵓ, "it bites the tongue."
131. ꜀*Nai*; ꜀*nai* ꜂*tsai* "a little."
132. ꜀*Nang*; ꜁*hám*-꜀*nang*-꜀*nang*, "very salt." ꜂*Ta*-꜀*nang*, "to tie a knot."

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† *Sic in orig.*

133. ꜀*Náu*; *yat*꜁-꜀*kú*-꜀*náu*, "all in a heap."
134. ꜂*Ng*; "yes."
135. *Ngá*^{2}; *ngá*^{2}-꜀*hoi tái*^{2}-꜂*pí* "bow-legged."
136. *Ngat*꜁; "to compel."
137. *Ngít*꜁; "to creak."
138. ꜀*Ním*; ꜀*fán*-꜀*ním*, "the guava."
139. ꜀*Ning*; ꜂*fu*-꜀*ning-ti* "bitter." *Ting*꜃ ꜀*ning yuk*$_2$ "a little tumour."
140. *Níp*꜁; "dinged in," "pinched," also read *níp*$_o$.
141. ꜀*No*; "to rub."
142. ꜀*O*; ꜀*o*-꜀*lí*, "stingy," "shabby."
143. *Oi*꜃; *oi*꜃-*chan*꜃, "now * * then."
144. *Ok*꜁; *ok*꜁ *ts'ui*꜃, "crisp." *Ok*꜁-꜂*tsui*, "to kiss."
145. ꜀*P'á*; "to shovel," as rice into the mouth.
146. *Pái*꜃; *pái*꜃-꜀*shá*, "to winnow rice."
147. ꜂*P'an*; [probably a rustic word] "thick," as cloth.
148.*a* ꜀*Pán*; ꜀*pán*-꜂*chi*, "a thumb ring." In imitation of the "mandarin" term.
149. ꜀*Pí*; ꜂*kau*-꜀*pí* "a dog tick."
150. *Pí*^{2}; "biting," to the tongue. "To drain off" the liquid.
151. ꜀*P'ing*; ꜀*ping*-꜂*kwo* "apples."
152. *Po*꜃; "to crouch" as behind a door, (? and) "pounce forth."
153. ꜀*Pu*; ꜀*pu*-꜀*pu* ꜀*sheng*, "whistling sound."
154. *Puk*$_2$; ꜀*sam puk*$_2$-*puk*$_2$ "palpitation."
155. *P'uk*꜁; "to fall down."
156. *Sang*꜃; "to wipe." "*Sang*꜃ *pí*^{2}-꜀*ko*, "wipe the nose."
157. *Sáp*$_o$; *sáp*$_o$-*yeuk*$_2$ "priming."
158. ꜂*Song*; "claws," as of a crab.
159. *Song*꜃; *ngong*^{2}-*song*꜃, "stupid."
160. *Suk*$_2$; "soft." ꜂*Un-suk*$_2$-*suk*$_2$ "soft," "velvety."
161. ꜀*Sung*; ꜀*sung* ꜂*tai*-꜂*tsz*, "a fool."
162. ꜂*Sung*; "to burrow," as pigs.
163. ꜀*Sz*; ꜂*tá* ꜀*sz-yik*꜁ "to belch."
164. *Tai*꜃; *tai*꜃-*lau*^{2} "a dropping," "an affair."
165. ꜂*Tái*; see, *sung*.
166. *Tuk*$_2$ *; ꜀*só-tak*$_2$ * "bristly beard."
167. ꜀*Tam*; ꜀*tam-ká*꜃, "dear." "To prevent."
168. ꜀*Tám*; "to hold in the mouth," as a cat.
169. ꜂*Tan*; ꜀*ch'éung*-꜂*tan*, "a sill." *Kám*-꜂*tan*, "a gaol-bird." ꜀*Sz*-꜂*tan*, "bamboo-poles" for winding silk. ꜂*Ch'ü*-꜂*tan*, a pedestal.
170. *Tan*꜃; "to boil" or "stew," by putting the pan in the water, used probably for *tun*꜃,
171. ꜀*T'an*; a sort of "clam."

172. *Táp˳*; "to tap." *Táp˳ kwat꜆* "to shampoo."
173. *Tat꜆*; "to dip."
174. *Tát˳*; "to heave." *Ko꜄-tát˳ ti^2-fong꜄* "that place."
175. *T'át˳*; *t'at˳-'hau*, "big-mouthed," as jars. *T'át˳-꜁hái*, "slip-shod."
176. *Tau꜄*; a "brood," or "litter."
177. *'Té*; "spoilt," as children. "Vulgar," "provincial."
178. *Ting꜄*; "throughout." *Shuk$_2$-꜁nam-ting꜄*, "quite ripe."
179. *꜀Tiu*; *꜀sün-꜀tiu-ti^2*, "sour."
180. *'Tiu*; "to copulate with."
181. *'To*; *'to-lok$_2$-꜁lai* "to bulge out." as the teats.
182. *꜀T'o*; *꜀t'o-lok$_2$-꜁lai* "to hang," as the teats.
183. *꜂T'o*; *꜂t'o-꜁ch'i*, "to put off."
184. *Tsán^2*; "to dip."
185. *Ts'at$_2$*; "the penis."
186. *Ts'éung꜄*; "choke." *Ts'eung꜄-'han* "choke with water."
187. *Tsín꜄*; *yuk$_2$-tsín꜄*, "a cushion."
188. *Tsuk꜆*; "to jump up," "to rear the head."
189. *Tsuk$_2$*; [*see chuk$_2$*], "to choke." "To egg on."
190. *Ts'uk꜆*; *ts'uk꜆ ꜀san*, "brand-new."
191. *Tsun^2*; [this sound is not found in Williams]. *Lo^2-lo^2-tsun^2*, "to loaf," "to hang about."
192. *Tsung꜄*; "to wriggle."
193. *꜀Tù (꜀tö)*; [this sound is not found in Williams]. *꜀Tù-꜀tù*, "a wee bit."
194. *꜀Tun*; *꜀tun-chu^2 ꜂k'ü*, "pin him down."
195. *꜀U*; *꜀u-m'-tó꜄* "can't reach."
196. *U^2**, "a bench, or stool." *꜂Mu-u^2**, "a bench.
197. *꜀Ui*; "to roast" in hot ashes.
198. *Ùk꜆ (ök꜆)*; [this sound is not found in Williams], *'tá-'páu-ùk꜆* "to hiccough."
199. *꜀Ün*; "to ache."
200. *Wo^2*; a suffix, denoting "said." *꜂K'ü m꜄-꜁lai wo^2*, "it was said he was not coming."
201. *Yam꜄*; "to sop up."
202. *꜁Yam*; "to haul up."
203. *꜁Yau*; *꜁yau-꜀tsz*, "washerman's itch."
204. *꜁Yeong*; *꜁yeong pí꜄* "to bare the arm."
205. *꜀Yui*; "to bore," "an awl."
206. *꜀Yung*; "loosely or badly stitched," "crooked."

LAST PICKINGS FROM THE DIALECT OF FOOCHOW.

The dialect of Foochow is, in many respects, the most interesting of the four under discussion. Besides the fact of there remaining many strange words, belonging presumably to some aboriginal language, there exist in this dialect two peculiarities which have been touched upon elsewhere by the writer of these papers, and which shall be further examined when a favourable occasion offers: reference is made to vowel inflection, and to tonic-inflection. Suffice it, however, for the present to bring forward a few quasi-characterless and colloquial expressions which have been omitted from the admirable dictionary of Mr. Baldwin. In the fifth paper a few of the popular words of the four dialects set forth in these separate lists will be collated into one table. so far as coincidences may seem to point to an unmistakable community of origin. The spelling used in this list is that of Mr. Baldwin, whose tonic marks, also, it will be convenient to use.

1. *A*ˀ; *꜀k'á-á*ˀ, "why?"
2. *꜁Ang*; *꜁ang-mang*², "blemish."
3. *Chak*꜆; "to spill. Probably the same as *chiak*꜆.
4. *'Ch'ang*; "lustful."
5. *Ch'au*ˀ; "to copulate." *Ch'au*ˀ*-k'ó*ˀ "to go out."
6. *Chek*꜆; "to rinse;" also read *chiak*꜆. See *chak*꜆.
7. *Ch'ëük*꜆; *ch'ëük*꜆*-ch'ëük*꜆ *꜀sing*, "brand-new." Same as *ch'öëk*꜆.
8. *Ch'iak*꜆; "to stick in," as a pin.
9. *Ch'ieng*ˀ; "to drive in," as stakes.
10. *꜀Ching*; *꜀ching-ch'oi*ˀ, "to kiss:" "weak," as gruel; (in this last sense also read *꜀ch'ing*.
11. *꜀Ch'iu*; *꜀wi-꜀ch'iu*, "shy. *T'iek*꜆ *꜀ch'iu*, "a spade." Also, "a snakes tongue."
12. *Chiong*ˀ; *꜀k'au-chiong*ˀ, "to beat," "to tack."
13. *Chok*꜆; *chok*꜆*-ch'oi*ˀ, "to kiss." Same as *chwok*꜆.
14. *'Chu*; *ó*² *'chu-paung*², "has some good, or stability in him."
15. *꜀Chüng*; *꜀chüng-ch'oi*ˀ, "to kiss." Probably the same as *꜀ching*.
16. *'Chüng*; *꜀ch'ó-'chüng*, "a spasm."
17. *꜀Eng*; *mó tói*ˀ*-꜀eng* "no answer." As when convicted. Probably for *eng*ˀ or *꜀ing*
18. *Eng*ˀ; *eng*ˀ*-꜀ta*, "to sop up."
19. *꜁Há*; *꜁há-lá*², "to droop" or "hang limp" as the lip, or the coat collar. Probably the same as *há*².
20. *Há*²; *꜁hang-há*², dilatory. Probably for *hai*².
21. *꜁Hang*; "dawdle," see *há*². *꜁Hang-taiu*ˀ, "dawdling."

22. *ʻHang; pah*ʾ*-ʻhang*, "husband's brother's wife."
23. *Hang*^{2}; *siong*^{2} *hang*^{2}, "the palate. Probably *hang*^{2}, "the chin."
24. *꜀Hë; ꜁hang ꜀hë*, "vamped up," "shably."
25. *Haing*^{2}; *ch'ao*ʾ *cheng*ʾ*-haing*^{2} "stinking."
26. *Hó*^{2}; *hó*^{2}*-hó*^{2} *hui*^{2}*-hui*^{2}, "confusedly."
27. *Hwang*^{2}; *mó*^{2}*-hwang*^{2}, "throat lash." Probably for *p'wang*ʾ.
28. *Kai*ʾ; "again."
29. *Kak*$_2$; "to stick," or "catch;" "to pry upon;" "a stye," "to soar," *꜁ëng kak*$_2$ "a stye," on the eye.
30. *꜀Kang; ꜀kang-ʻma ꜁iu*, "tar."
31. *꜁Kë; ma*^{2} *tai*^{2}*-꜁kë*, "useful."
32. *꜀K'ë; ꜀k'ë ꜀lëng*, "a hole."
33. *꜀K'eng; ꜀k'eng-hok*ʾ, "ganglion."
34. *꜀K'ie*; "loss," "defalcation;" probably for *꜀k'wi*.
35. *꜁K'ieu; ꜁sing-꜁k'ieu*, "to provoke."
36. *꜁Kó; ꜁kó-taung*^{2}, "to rinse."
37. *꜁K'ó*; "to lean against," unconsciously.
38. *K'ok*$_2$; *k'ek*$_2$*-k'ok*$_2$, "blemish," "fault."
39. *ʻKu*: *ʻchi-ʻku* "now" *ʻku-luk*$_2$, "to mutter."
40. *꜀K'u*; "to set on," as a dog. "Vegetable beds."
41. *Kuk*$_2$; "thick," "not watery."
42. *Kwang*ʾ; *lioh*ʾ *kwang*ʾ*-kwang*ʾ, "green."
43. *ʻK'wi*; *ʻk'wi-lik*$_2$, "strength."
44. *꜀K'wong; twai*^{2}*-꜀k'wong* "liberal." *Sa*ʾ*-꜀k'wong* "mean." Probably for. *꜀hwong*.
45. *Lá*^{2}; see *꜁há*.
46. *Laëng*^{2}; *꜀pwong-laëng*^{2}, "the temples."
47. *Lai*ʾ; *ch'iah*ʾ *꜁mó lai*ʾ "a caterpillar." *꜀Ch'u-꜀ch'u lai*ʾ*-lai*ʾ, "rough," "coarse."
48. *꜁Leu; ꜁leu-sëu*^{2}, "to chaff."
49. *Liah*ʾ; *sioh*$_2$ *liah*ʾ (the same as *chiah*ʾ) "one piece."
50. *꜀Ló*; to soar," or "fly slowly."
51. *꜁Ló; ꜁kó-꜁ló* "will it be long yet?"
52. *Loh*ʾ; *koh*ʾ*-loh*ʾ*-a*^{2}, "armpit."
53. *Luk*$_2$; see *ʻku*. *꜀P'u-luk*$_2$ *ch'ien*ʾ, "to burst out with laughter." *Lik*$_2$*-luk*$_2$ *k'ó*ʾ "to throw away." *꜁Pu-luk*$_2$ "to roll over," to "shake one's self."
54. *꜁Ma; ꜁ma-꜁ma loh*$_2$, "copious flow," as of tears.
55. *ʻMa; ꜀kang-ʻma-꜁iu*, "tar."
56. *Mai*ʾ; "sting"; *ʻmëng-mai*ʾ "a mosquito's bite," or sting.
57. *Mang*^{2}; see *꜁ang*.
58. *꜀Ming; ꜀ming-ʻlá*, "regardless of consequences."
59. *Mó*ʾ; "to strike," "to crush. Probably a form of *mó*^{2}.

60. *Mwai*ɔ; "sting," see *mai*ɔ.
61. *Naik*ɔ; *nek*₂-*naik*ɔ "stealthily. Same as *naing*ɔ, *niak*ɔ ,and *niek*ɔ.
62. *Nau*²; *t'au*ɔ-*nau*², "a kidnapper." The balance of a scale. ꜀*Tieng-nau*² "the twisted balance cord of a scale;" "difficulty."
63. ꜂*Nó*; ꜀*wai*-꜀*wai* ꜂*nó*-꜂*nó*, "crooked."
64. ꜀*P'á*; ꜀*chiung*-꜀*p'á*-꜀*p'á*, "insipid."
65. *Paing*²; ꜂*ta paing*², "to dress one's self out."
66. *P'aing*ɔ; "perverse," "overbearing."
67. *Pe*ɔ; "biting," to the tongue.
68. ꜀*Pi*; ꜂*k'eng*-꜀*pi*, "a dog-tick."
69. ꜁*Pi*; *sioh*₂ ꜁*pi* ꜁*pwo*-꜁*tó*, "a bunch of grapes."
70. ꜁*Pwo*; ꜁*neng*-꜁*pwo*, "the breasts."
71. ꜂*P'wo*; *ch'ai*ɔ-꜂*p'wo*, "a vegetable" somewhat resembling a dead rat.
72. ꜀*Sá*; ꜀*á*-꜀*sá*, "delay."
73. ꜂*Só*; *sioh*₂-꜂*só*, "the stone," used in military exercises.
74. *Taëng*ɔ; "a toad." *Kwok*ɔ-*taëng*ɔ a toad.
75. *Taing*ɔ; ꜁*pá-taing*ɔ, "to roll from side to side."
76. *Taiu*ɔ; see ꜀*hang*. Probably for *taiu*².
77. ꜁*Tang*; to "kick," or "spur."
78. *Tau*ɔ; "to soar."
79. ꜂*Teu*; to copulate. ꜂*Teu* ꜂*nü* ꜂*ná*! a vulgar imprecation.
80. ꜂*T'iang*; "a garden-bed."
81. *Tó*²; *taing*²-*tó*², "firm, strong."
82. ꜂*Tong*; ꜁*kio*-꜂*tong*, "bastions or pedestals," of a bridge.
83. *Tong*ɔ; "to tie down."
84. ꜀*Twi*; *loi*²-꜀*twi*, "to bother."
85. *Wo*²; "to poach," as eggs.

In the epitome which occupies the three pages following, will be found grouped together a very small selection of words, being a few of those in the preceding four lists which seem incontestably to be allied together. Moreover no notice is taken of the numerous characterless words given in the dictionaries of Baldwin and Williams, many of which in each work will bear comparison with similar words in the other, and with characterless words, or words for which spurious characters are used, in Pekingese. Students who take an interest in the subject can work out these analogies for themselves, taking care, it is

hoped, to give consideration to every point which may render the comparison one of philological value. Following this epitome will be found a table shewing the exact vowel sounds of the words spelt so differently by Wade, Williams and Baldwin; and giving, in a separate column, vowels which may be privately used by students for their own convenience, and to prevent anomaly or confusion in any notes which they may make of peculiarities gathered from the works of the three writers mentioned. Nearly all the words in the preceding four lists find more or less probable counterparts in Wade, Williams, or Baldwin, as the case may be, or in the lists themselves.

Peking.	Hankow.	Canton.	Foochow.	Meaning.
1. *Ch'a*^{2}	....	*Ch'á'*	....	Squat, open.
2. *Chi*^{1}*-liao*^{3} ...	*Tsz*^{1}*-liu*^{2}	....	....	Cicada.
3. *Ch'iao*^{3}........	....	*Ts'at*^{2}	....	Penis.
4. *Ch'ien'*	....	....	*Ch'ieng'*	Drive in, as stakes.
5. *Han*^{1}	*Hung*^{1}	....	... .	Thick, big.
6. *Hsi*^{1} *(li*^{2}*-si*^{4}*)*	....	....	*Söü*^{2} *(*$_{\varsigma}$*leu seü*^{2}*)*....	To chaff.
7. *Ka*^{1}*-nüeh*^{4} ...	*Ka*^{1}*-lüo*^{5}	....	....	Abrupt.
8. *Kan*^{1}*-lan*^{2} ...	*Kan*^{1}*-lan*^{2}.......	....	....	Simply.
9. *Ko*^{1}	*Ko*^{5}	....	*K'ok*$_{2}$	Scab, blemish.
10. *Ko*^{4} *k'o*^{2}	....	....	*Kak*$_{2}$	To stick, to catch, to run against.
11.	....	$_{\varsigma}$*K'au*	$_{\varsigma}$*K'au*	To tack, to beat.
12. *Kung*^{3}	*Kung*^{3}	*'Kung*............	....	To burrow.

Peking.	Hankow.	Canton.	Foochow.	Meaning.
13.	....	*Küt*$_{\circ}$	*Kük*$_{2}$	Thick, not watery.
14. *Kwai* ^{3}	....	ˤ*Kʻwai*	....	Naughty.
15. *La* ^{1}	....	ʿ*Lái*	....	To lap up.
16. *Ma* ^{1}-*sa* ^{1}	*Ma* ^{1}-*sa* ^{1}	....	....	To pat; to gloss over.
17. *Mu* *-*la* ^{3}	....	ʿ*Mái*	....	To munch.
18. *Na* ^{4}	....	ʿ*So-nát*$_{2}$	....	Clarinet.
19. *Pi* ^{4}	....	*Pi*ᵓ	*Pe*ᵓ	To drain off.
20.	....	*Pi*ᵓ	*Pe*ᵓ	Biting.
21. *Pieh* ^{1}	....	˛*Pi*	˛*Pi*	Leech, dogtick.
22. *Pieh* ^{3}	*Pieh* ^{4}	....	....	Left handed.
23. *Pʻu* ^{2}	....	....	ˬ*Pwo*	Bosom.
24. *Tʻang* ^{1}	*Tʻang* ^{3}	....	....	To wade.

	Peking.	Hankow.	Canton.	Foochow.	Meaning.
25.	....	*Tên*^{4}	*Tanʼ*	....	Heap, pedestal.
26.	....	....	*ʻTiu*	*ʻTeu*	To copulate.
27.	*T'o*^{2}-*lo*^{2}	*Lé*^{5}-*lé*^{5}	....	....	A top.
28.	....	....	*꜀Tun*	*Tongʼ*	Tie down.
29.	*Ts'u*^{4}	*Ts'ou*^{5}	*Ts'uk꜇*	*Ch'ëuk꜇*	Brand-new.
30.	*Tsung*^{4}	....	*Tsungʼ*	....	Creep, wriggle.
31.	....	*Tsz*^{1}	*Chat꜇*	....	To rub.
32.	*Wo*^{4}	....	....	*Wo*^{2}	To poach.
33.	*Wu*^{4}	....	*U*^{2}*	....	Stool.
34.	....	....	*Yamʼ*	*Engʼ*	Sop up.

In judging of the possibility of some of the phonetic words in the preceding epitome having relation to each other in respect of their origin, it may be well to keep before the eye the table of tones appended. This is not the place for a detailed monograph upon tones, a subject which must be separately treated on some other occasion. Suffice it for present purposes to say that the most searching enquiry and careful reflection point to the following conclusions.

1.—That the Pekingese dialect, whether colloquial or otherwise, has but four tones, which are never modified, except inasmuch as they change slightly, in a rhythmical sense, accordingly as the words are grouped; but these changes are not positive, still less indispensable, least of all recognised systematically by the natives. The modifications are *instinctive.*

2.—The dialect of Hankow has, in practice, four tones, though five are counted; two being identical. Tonic inflection in this dialect, as in Pekingese, is practically non-existent.

3.—In Foochow there are seven tones in practice, and, in fact, only seven, generally speaking, in theory; even the recollection of the eighth having almost passed away, since it has become identical with another tone. Both tonic, consonant, and vowel inflection are, in this dialect, positive, rigid, indispensable, and all-pervading; not only to their fullest extent, in conversation, but also, to a great extent, in reading aloud from books or papers.

4.—In Cantonese there are eight tones positively and systematically recognised by name in vocabularies, and a ninth, so universally recognised, indirectly, in local vocabularies, that it may be safely stated roundly that there are nine *bonâ fide* tones in the dialect. In reading aloud from books these never modify, except perhaps in reading from vulgar song-books or popular romances. In conversation, there is no consonant or vowel inflection whatever, but the tones are modified, *not as in Foochow from one genuine tone to the other*, but into a series of *new* tones, numbering, relatively, nine, but, actually and positively, only three.

These eighteen Cantonese *nominal* tones, are thus reduced in practice, setting aside all consideration of the consonant, nasal or vowel terminations of the words, to twelve. Hence we have, in the four dialects under discussion, respectively, four tones for Pekingese, four for Hankow, seven for Foochow, and twelve for Canton; or twenty-seven in all. But some of the tones, or voice cadances in one dialect actually resemble those in another, although

in name they differ widely. The table appended reduces these thirty-five tones to nine groups, each containing from two to four tones which strike the ear in a similar manner. There are six tones which will not fall into any of these groups, so that for the thirty-five tones in the four dialects we get fifteen cadences in all. To be perfectly exact, tones numbers 1, 3, and 24 have been placed separately. As a matter of fact, however, tone number 1 might be safely classed with tones numbers 17, 18 and 30, as the difference is so slight as to be imperceptible to the ordinary ear; and it is besides immaterial whether this tone is pronounced as it should be or like the others with which it is compared. Similarly, tone number 3 might form a separate class with tone number 24, which it almost invariably resembles: however, it is equally accurate to pronounce this tone as numbers 8, 16, and 22; so that, to avoid hostile criticism, we have placed it, as it really should be placed by the fine ear, separate from both. Were tones numbers 1, 3, and 24 grouped as suggested, the actual voice cadences covering the whole thirty-five tones would be reduced to thirteen.

TABLE OF TONES.

	平				仄													
	平				上				去				入					
PEKING............	1 上平		2 下平		3 上				4 去									
HANKOW	5 上平		6 下平		7 下				8 去				9 入					
FOOCHOW	10 上平		11 下平		12 上上		13 下上		14 上去		15 下去		16 上入				17 下入	
													上入		中入			
CANTON	18 正上平	19 上平變音	20 正下平	21 下平變音	22 正上上	23 上上變音	24 正下上	25 下平變音	26 正上去	27 上去變音	28 正下去	29 下去變音	30 正	31 變音	32 正	33 變音	34 正下入	35 下入變音

a; Nos. 5, 10, 19, 31.
b; „ 6, 9, 20.
c; „ 7, 11.
d; „ 8, 16, 22.
e; „ 12, 13, 26, 32.
f; „ 15, 28, 34.
g; „ 17, 18, 30.
h; „ 21, 25, 29, 35.
i; „ 23, 27, 33.
Separate; Nos. 1, 2, 3, 4, 14, 24.

The accompanying table of words and diphthongs will serve to render clearer the probabilitiesof any resemblances which students may detect in the words given in the four lists.

No.	Spelling of Wade.	Spelling of Williams.	Spelling of Baldwin.	Spelling modified so as to suit all Dialects.	Explanation of sound intended to be represented.
1	a	á	a	a	E. f*a*ther.
2	,, ...	,, ...	ă	ă	E. b*a*ck.
3	,, ...	,, ...	á	ae	F. *é*t*ei*ndre.
4	,, ...	,, ...	aë	aö	G. bein*ah ö*lig.
5	,, ...	ai	,, ...	ai............	F. n*aï*ve.
6	ai	ái	ai	aai	G. K*ai*ser.
7	,, ...	au	,, ...	au	E. br*ow*.
8	ao	áu	au	aau	G. *au*s.
9	,, ...	e	é	e	E. s*e*nd.
10	eh	é	é	ee	F. p*è*re.
11	ei............	ei............	e	ei	E. f*ei*nt.

No.	Spelling of Wade.	Spelling of Williams.	Spelling of Baldwin.	Spelling modified so as to suit all Dialects.	Explanation of sound intended to be represented.
12	ei……	ei……	eu ……	eu ……	It. d*eh!* *u*miltá!
13	,, ……	Distributed amongst ü, ui, úi, ……	öü ……	öü ……	F. p*eu* *u*sité.
14	i ……	i ……	í ……	i ……	E. pin.
15	,, ……	í ……	i ……	y ……	E. mach*i*ne.
16	,, ……	,, ……	iă ……	iă ……	F. f*ia*cre.
17	ia ……	,, ……	,, ……	ia ……	F. bi*ll*ard.
18	,, ……	,, ……	ieu ……	ieu ……	It. cos*ì!* *eh!* *u*miltà.
19	ieh ……	,, ……	ié ……	iee ……	F. l*ie*vre.
20	,, ……	,, ……	io ……	iou ……	F. c*i* *au* nez.
21	io ……	,, ……	,, ……	io ……	F. l*io*n.
22	iu ……	iú ……	iu ……	iu ……	E. p*ew*.

No.	Spelling of Wade.	Spelling of Williams.	Spelling of Baldwin.	Spelling modified so as to suit all Dialects.	Explanation of sound intended to be represented.
23	o	o	ó	o	F. ton.
24	,,	oi	,,	oi	E. *toy*.
25	ou	ó	o	ou	E. m*ou*ld.
26	u	ú	u	uu	E. r*u*se.
27	u	u	u	u	E. b*u*ll.
28	ü	ü	ü	ü	F. p*u*.
29	,,	ú and éu	ö	ö	G. König.
30	ua	,,	,,	ua	F. j*oua*ble.
31	üa	,,	,,	üa	F. *tu as*.
32	üeh	,,	,,	üee	F. v*ue airée*.
33	uei	,,	,,	uei	E. s*wai*n.

No.	Spelling of Wade.	Spelling of Williams.	Spelling of Baldwin.	Spelling modified so as to suit all Dialects.	Explanation of sound intended to be represented.
34	ui	ù	ui	ui	F. so*ui*ller.
35	,,	úi	,,	uui	F. in*oui*.
36	uo	,,	,,	uo	It *uo*mo.
37	üo	,,	,,	üo	F. v*ue o*riginale.
38	,,	,,	woi	uoi	It c*uo*(r') *i*nfidele.
39	ê	a	,,	ê	E. f*u*n.
40	,,	,,	·oi	oui	F. l'*eau y* est.

ARTICLE III.

DROUGHTS IN CHINA, A.D. 620 TO 1643.

By Alex. Hosie, M.A.,

H. B. M.'s China Consular Service.

THE attention of the compiler of the accompanying Tables was drawn to the subject of Droughts in China by the numerous Articles on the Indian Famines that have appeared in various newspapers and periodicals. In an article in the *Edinburgh Review* for July 1877 the dates of the most serious Indian famines on record are exhibited in a tabular form; and it was this form which first suggested to the compiler the idea of ascertaining, as far as possible, the dates of famines recorded in China. The task would have been no easy one had not fortune favoured his researches. The recent acquisition by Her Majesty's Government of the great compendium of Literature known as the *T'u Shu Tsih Ch'êng* 圖書集成 permitted the categorical records forming part of this collection to be placed under requisition. The section of this compilation entitled *Shu Ch'eng Tien* 庶徵典 (or Natural Phenomena) contains among a multitude of other historical and statistical matters a record of the Droughts and Famines that have occurred in China from the mythical ages of its history to the beginning of the present dynasty. (*) The compiler resolved, however, to confine his investigations to a strictly historical period. With this end in view, he selected the commencement of the T'ang dynasty as a starting point. From this point to the end of the Ming dynasty, a period embracing more than one thousand years (620-1643), several hundreds of droughts have been recorded, occasioning in many instances what may be called local dearths and in others wide-spread famine and distress.

(*) 庶徵典, *Kuan* 86—96, heading 旱災 (Droughts.)

The plan on which the Tables are constructed is as follows:—

The first column contains the years, the second the seasons of the year, and the third the provinces in which droughts have occurred. In the fourth column collateral events have occasionally been noted, such as the visitations of locusts, the occurrence of floods, the prevalence of some description of plague or typhus fever, the appearance of comets, etc., etc. Note has also been made in this column when the droughts have been of more than ordinary severity and duration.

In assigning dates the compiler has followed the chronology adopted by Mr. Mayers.(*)

As it would have been an endless labour to record the names of all the suffering regions, they have, as far as possible, been classed under the eighteen provinces of the present dynasty. It must not therefore, be supposed that, when a province is mentioned, the whole of that province has suffered from drought. On the contrary, cases occur where the affected area has been confined to a single *hien* or district.

The frequency with which one, two, and even three provinces have suffered from drought for several successive years is a phenomenon which deserves attention. Take for example the period of forty years between 1170 and 1209, both inclusive. The province of Chêhkiang is recorded in the six consecutive years 1170 to 1175, in the four consecutive years 1180 to 1183, in 1187, in the the two consecutive years 1193 and 1194, in 1196, in the three consecutive years 1200 to 1202, and in the six consecutive years 1204 to 1209. Within the same period the province of Kiangsi is recorded in 1171, in 1173, in the three consecutive years 1180 to 1182, in 1184, in the two consecutive years 1186 and 1187, in 1194, and in the three consecutive years 1204 to 1206. One more instance will suffice. Within the same period of forty years, the province of Sze-ch'wan is recorded in the three consecutive years 1181 to 1183, in the four consecutive years 1190 to 1193, in 1197, in 1201, and in 1205. Cases in which two or more provinces have been affected simultaneously and for several consecutive years, though not so common, cannot be called rare. In the period of thirty seven years between 1296 and 1332, the two provinces of Chihli and Honan suffered simultaneously in the three consecutive years 1296 to 1298, in the two consecutive years 1300 and 1301, in the five consecutive years 1324 to 1328, and in the three consecutive years 1336 to 1332. In the three consecutive years 990 to 992 the three provinces of Chihli, Honan, and Shensi are recorded as having been simultaneously affected.

(*) *Chinese Reader's Manual*, Part II.

One fact which must strike even the most unobservant reader of the accompanying Tables is the frequency with which the provinces of Chihli, Honan, Shansi, and Shantung have suffered simultaneously or in successive years. This is all the more remarkable as bearing a striking analogy to the droughts and consequent famines that have occurred within the last few years. In 1876, Chihli and Shantung, and in 1876 and 1877, Honan and Shansi have been the suffering provinces.

The severity with which famine has raged in China may be conjectured from the frequent mention that is made of the existence of cannibalism. The feeling of horror which this word conveys to the mind is greatly intensified when it is made to include in its meaning the case of parents devouring their own offspring.

Not only has the land-tax been remitted in numerous instances, but government relief has been afforded in almost every year of great drougnt. Let us counterbalance this, however, with the probable insufficiency of the relief afforded, the absence of means of communication and of facilities for transport, and the prevalence of famine-typhus, and we have a picture of distress, alas! too common in these later times. Is it matter for wonder, then, that mention is frequently made of apalling mortality? So long as China refuses to adopt the discoveries of modern science, so long will she be unable to cope with the miseries of the famines which cannot fail in the future as in the past to harass some portion or other of her wide dominions.

It only remains for the compiler to give a short description of the work upon which the accompanying Tables are based.

The *K'in Ting T'u Shu Tsih Ch'eng* (*) is a vast Encyclopædia of Universal Knowledge compiled in the reign of the emperor K'ang Hi in the early years of the 18th century, from the various books that had appeared in China prior to that period, and printed in beautiful type under the superintendence, it is believed, of the Jesuit missionaries. It consists of 520 *t'ao* or cases comprising 5000 *pên* or volumes, and has a General Index of 20 volumes. The whole of the matter contained in this enormous work is classified under six great heads, which are again sub-divided into thirty-two sections.

This great storehouse of learning was purchased in November of last year on behalf of the British Museum.

(*) 欽定圖書集成.

In the discussion which followed the reading of Mr. Hosie's paper it was pointed out that more than one cause might produce a drought in any particular locality in China; and that in making use of the tables it would be necessary to bear this fact in mind. There is in China no mountain range of sufficient altitude or importance to determine the northern limit of the summer monsoon. During the year 1877, which was exceptional in many respects, the monsoon could scarcely be said to have reached the valley of the Yangtsze; and in consequence central and southern China was drenched with excessive rain, while not a drop fell in the parched and famine stricken provinces of Chihli and Shansi. In the years 1867-69 droughts in the north were severely felt, though not sufficiently intense to cause famine, while the valley of the Yangtsze was flooded to such a degree as to cause a local scarcity. In 1871 a remarkable change took place and Chihli, Shingking and the other northern provinces suffered from an excess of rain, while Chehkiang and partially Kiangsu were deprived of their ordinary rainfall. One incident in connexion with the distribution of rain in this latter year is worthy of note. The monsoon at Shanghai generally breaks up about the end of August and cooler weather and variable winds mark the beginning of September. In 1871 the summer monsoon had apparently broken up, and the residents were looking forward to ordinary autumnal weather. On the 4th September the southerly monsoon again set in with a remarkable rise in temperature, the average by day being 86°. Increasing during the week from the 16th to the 22nd to 91°. The enormous quantities of water carried north by this unusual phenomenon were deposited in a belt from 150 to 200 miles wide, and which was traced from Shantung by Peking, Siuen-hwa-foo, Tai-yuen-foo to the valley of the upper Han and the north and west of Sze-ch'wan, in the latter district lasting for six days and causing a local famine. The length of this belt of rainfall must thus have been at least 1,500 miles. How much further west it extended there is no information to guide in forming a judgment.

A drought may thus arise from one of two causes. Either the summer monsoon may extend beyond its ordinary northern limit; in which case those districts which are well within its limits will suffer from comparative drought, while floods will prevail along its northern edge; or, on the contrary it may not have reached its ordinary development; and those regions which lie outside will, as in the past year, suffer intensely from want of rain.

The year 1871 may thus be described as a year of powerful radiation, while 1877 was marked by a lower range of temperature in mid-China than had been previously recorded. Statistics of floods will thus be seen to have as important a bearing on the question of periodicity as those of droughts, as affording a possibly surer indication of the causes which have led to an absence of rain from any particular locality.—*Ed.*

Year.	Season of Year.	Provinces.	Remarks.
620	Spring ...	....	
	Summer	....	
	Autumn	....	
621	Spring ...	....	
	Summer	....	
	Autumn	....	
624	Autumn	Shantung ...	
		Shensi	
627	Summer	Shantung ...	Land-tax remitted.
628	Spring ...	....	Locusts.
629	Spring ...	Shensi	Very severe.
	Summer		
630	Spring ...	....	Floods.
635	Autumn	Shansi	
		Sze-ch'wan	
638	Summer	Hunan	
		Hupeh	
		Kiangsu ...	
		Sze-ch'wan	
639	Summer	Hunan	
		Hupeh	
		Kiangsu ...	
		Sze-ch'wan	
643	Spring ...	....	Great drought.
	Summer	....	
647	Autumn	Shansi	
		Shensi	
		Sze-ch'wan	
648	Autumn	Sze-ch'wan	
	Winter ...		
649	Spring ...	....	
650	Spring ...	Shansi	
	Summer	Shensi	
	Autumn		
651	Autumn	....	
	Winter ...	....	
652	Spring ...	....	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
653	Summer Autumn	Anhwei ... Honan	Very severe.
654	Spring ...	....	
659	Autumn	....	
660	Spring ...	Chihli	
664	Summer	....	Of long duration; no snowfall.
667	Spring ... Autumn	....	
668	....	Kiangsu ... Shantung... Shensi	Great drought.
669	Autumn	Sze-ch'wan	No snowfall during winter.
670	Spring ... Autumn	Shansi ...... Shensi	Very severe.
671	Summer	....	
675	Summer	....	
677	Summer	Chihli ...... Honan	Great drought and of long duration.
678	Summer	....	
681	Spring ...	Shansi ...... Shensi	Two years' land-tax remitted. Great floods in Chihli and one years' tax remitted.
682	....	Shensi	Great drought.
683	Summer	Chihli ...... Honan	
685	Summer	....	
686	Winter...	....	No snowfall.
687	Spring ... Summer	....	
689	....	....	
690	Spring ...	....	
694	Spring ...	....	
697	....	....	
700	Summer	Shantung... Shensi	
702	Spring ... Summer	....	
703	Summer	....	No snowfall during winter.

Year.	Season of Year.	Provinces.	Remarks.
706	Summer Winter...	Chihli ...... Honan ...... Shantung... Shensi	Severe. Floods in Chihli.
707	Summer	....	
709	Summer	....	
712	Autumn	....	Excessive heat.
713	Spring ...	....	
714	Spring ...	Shensi	Great drought.
715	Summer	....	
718	Autumn	....	Very severe.
719	Autumn	....	
721	Winter...	....	No snowfall.
724	Autumn	Chihli ...... Shansi ...... Shantung...	
726	Summer Autumn	Chihli ...... Shansi	Of long duration.
727	....	....	
728	....	Honan	
729	Winter...	....	No snowfall.
731	Summer	Shensi	Of long duration.
733	Summer	....	Of long duration.
736	Summer	....	
743	Winter...	....	No snowfall.
747	Autumn	....	
750	Spring ...	Shensi	
755	Spring ...	....	
758	Summer	....	
759	Spring ...	....	Of long duration.
763	Spring ... Summer	....	
764	Spring ... Summer	Shensi	Great drought.
765	Summer	....	Great drought.
766	Winter...	....	No snowfall.
771	Spring ... Summer Autumn	....	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
772	Summer	....	
773	....	Shensi	Great drought.
777	Summer	....	No snowfall during winter.
780	Winter...	....	No snowfall.
782	Summer Autumn	....	
784	Winter...	....	Great drought.
785	Spring ... Summer Autumn	....	Very severe. Wells and rivers dried up.
790	Spring ... Summer	Chêhkiang Fuhkien ... Honan ...... Kiangsu ... Shensi	Great drought in Shensi. Wells and rivers dried up. Typhus fever raged.
791	Winter...	Anhwei ... Kiangsu ... Hupeh	No snowfall.
794	Spring ... Summer	....	
795	Summer	....	
796	Summer	....	Of long duration.
797	Spring ... Summer	....	
798	Winter...	....	No snowfall.
799	Spring ... Summer	....	
802	....	Honan	
803	Spring ... Summer Autumn	....	Great drought.
804	....	Honan ...... Shensi	
805	Autumn	Chêhkiang Honan ...... Hunan ...... Hupeh ...... Kiangsu ...	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
808	....	Anhwei ...	
		Hunan	
		Kiangsi ...	
		Kiangsu ...	
		Kwangtung	
		Shansi	
		Shantung ...	
809	Spring ...	Chêhkiang	Great drought. Land-tax remitted.
	Summer	Hunan	
	Autumn	Hupeh	
		Kiangsi ...	
		Kiangsu ...	
812	Summer	Kiangsu ...	
813	Summer	Shensi	
814	Summer	Honan	Land-tax remitted.
		Shensi	
815	Spring ...	....	
820	....	....	
822	Winter...	....	
823	Spring ...	Chêhkiang	
		Kiangsi ...	
		Kiangsu ...	
825	Autumn	Chêhkiang	
		Hunan	
		Hupeh	
		Kiangsu ...	
		Kiangsi ...	
826	Summer	Shensi	
827	Summer	Shansi	
		Shensi	
829	Autumn	Shensi	Land-tax of nine districts remitted.
832	Autumn	Honan	
		Shantung...	
		Shensi	
833	Autumn	....	Great drought.
834	Summer	Kiangsu ...	
		Shensi	
835	Autumn	Honan	
		Shansi	
		Shensi	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
836	Spring ...	....	
837	Spring ... Summer	....	Great drought; said to be connected with a comet which appeared in this year.
838	Spring ...	....	
839	Summer	Chêhkiang	Very severe.
840	Summer	Chêhkiang Chihli ...... Fuhkien ... Honan ...... Kiangsu ...	Land-tax remitted. Locusts. Typhus fever raged.
845	Spring ...	....	
846	Spring ...	....	
847	Spring ...	....	
850	....	....	Great drought.
854	Spring ...	....	
855	Autumn	Anhwei ... Chêhkiang Kiangsu ...	
858	Winter...	....	
861	Autumn	Honan ...... Kiangsu ...	
868	....	Kiangsu ...	
869	Summer	....	Locusts.
870	Summer	....	
873	Autumn	....	
874	Summer	....	
876	Spring ... Summer	Chêhkiang Kiangsi ...	No snowfall during winter. Land-tax remitted.
880	Spring ...	....	Great drought.
884	....	Anhwei ... Kiangsi ... Kiangsu ...	Great drought. Cannibalism existed.
893	Autumn	....	Great drought.
900	Winter...	Shensi	
901	Spring ...	....	
905	Summer	....	
908	Spring ...	....	
911	Spring ...	....	Of long duration.

Year.	Season of Year.	Provinces.	Remarks.
912	Spring ... Summer	....	
923	Spring ... Summer	....	No snowfall during winter.
924	Spring ..	....	
925	Spring .. Summer	....	
926	Summer	....	
927	Summer	....	
928	Winter...	....	No snowfall.
929	Spring ...	....	
930	Summer	....	
931	Summer	....	
932	Autumn	Hunan	Great drought.
933	Autumn	....	
934	Summer	Honan	Of long duration. Many people died from sunstroke.
935	Spring ... Summer	Honan	
936	Spring ... Summer Autumn	Honan	No snowfall.
937	Winter...	....	No snowfall.
938	Autumn	....	Floods.
939	Summer Autumn	....	
941	Autumn	Hupeh	Great mortality.
942	Spring ...	....	
943	Summer	....	Of long duration. Locusts.
946	Spring ... Summer	....	Of long duration.
948	Spring ... Summer	....	Of long duration.
952	Summer	....	Great drought. No snowfall during winter.
953	Spring ... Summer	....	Great drought; wells and rivers dried up. *Hwang Ho* fordable on foot. Locusts.

Year.	Season of Year.	Provinces.	Remarks.
954	Spring ... Summer	....	Typhus fever raged. Soupkitchens opened.
960	Autumn	....	
961	Summer Winter...	Honan	
962	Spring ... Summer	Chihli ...... Honan	Great drought in Chihli.
963	Summer Autumn Winter...	Honan	
964	Spring ... Summer	Honan ...... Shensi	Very severe.
966	Spring ... Summer Autumn	Shensi	Land-tax remitted.
967	Spring ... Autumn	Honan	Land-tax remitted.
968	....	Honan	
969	Summer Autumn	Honan	
970	Spring ... Summer	Honan ...... Shensi	
972	Spring ... Winter...	Honan	
973	Winter...	Honan	
974	Spring ... Summer Autumn	Chihli ...... Honan ...... Shansi	
975	Spring ...	Honan ...... Shensi	Very severe.
977	Spring ...	Honan	
978	Spring ... Summer	Honan	
979	Summer Winter...	Honan	
980	Summer Autumn	Honan	
981	Spring ... Summer	Honan	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
987	Winter...	Honan	
989	Summer Autumn Winter...	Chihli ...... Honan ...... Shantung...	Great drought. Granaries opened. Comet appeared in this year.
990	Spring ... Summer Autumn	Chihli ...... Honan ...... Shensi	
991	Spring ...	Chihli ...... Honan ...... Shantung... Shansi ...... Shensi	Great drought. Locusts.
992	Spring ... Summer Winter...	Chihli ...... Honan ...... Kiangsu ... Shensi	Great drought in Honan.
993	Summer	Honan ...... Shensi	
994	Summer	Honan	
995	Spring ...	Honan	No snowfall during winter.
996	Spring ... Summer	Honan	
998	Spring ... Summer	Chêhkiang Honan ...... Hunan ...... Hupeh ...... Kiangsi ... Kiangsu ...	
999	Spring ...	Chêhkiang Honan ...... Hunan ...... Hupeh ...... Kiangsi ... Kiangsu ... Kwangsi ... Shansi ...... Shantung...	Great drought.

Year.	Season of Year.	Provinces.	Remarks.
1000	Spring ...	Anhwei ...	
		Honan	
		Hunan	
		Hupeh	
		Kiangsi ...	
		Kiangsu ...	
1001	Spring ...	Honan	
	Summer		
1004	Summer	Anhwei ...	Many people died from sun-stroke in Honan.
		Honan	
		Kiangsi ...	
		Kiangsu ...	
1005	Autumn	Kiangsu...	
1006	Summer	Honan	
1008	Spring ...	Chihli	
1009	Spring ...	Honan	
	Summer	Shensi	
1010	Summer	Anhwei ...	
	Autumn	Honan	
		Kiangsi ...	
		Kiangsu ...	
1011	Summer	Honan	
1012	Summer	Chêhkiang	
		Kiangsu ...	
1015	Spring ...	Honan	
1016	Autumn	Chihli	Locusts.
		Honan	
1107	Spring ...	Honan	
	Summer	Shensi	
	Autumn		
1018	....	Shensi	
1020	Spring ...	Honan	
	Summer		
1021	Winter...	Honan	
1024	Spring ...	Honan	Great drought.
1025	Autumn	Shensi	Land-tax remitted.
1027	Summer	Honan	Great drought.
	Autumn	Shensi	Land-tax remitted.
			Locusts.
1028	Summer	....	

Year.	Season of Year.	Provinces.	Remarks.
1031	Winter...	....	
1032	Spring ... Summer	Honan ...... Kiangsu ...	Of long duration.
1033	Autumn	....	Great drought. Typhus fever raged. Locusts. Soup kitchens opened.
1036	Summer	Chihli	Of long duration.
1037	Summer	....	
1041	Autumn	....	
1042	Summer	....	
1043	Spring ... Summer	....	
1044	Spring ...	Chêhkiang Kiangsi ... Kiangsu ...	
1045	Spring ...	....	Of long duration.
1046	Summer	....	Many died from sunstroke. Of long duration.
1047	Spring ...	Honan	Great drought.
1049	Summer	....	
1050	Spring ...	....	
1051	Spring .. Summer	Chihli	
1052	Winter...	....	No snowfall.
1053	....	....	Locusts.
1055	Spring ...	Honan	
1058	Autumn	Sze-ch'wan	
1060	Summer Autumn	Sze-ch'wan	
1062	Spring ...	....	
1064	Spring ... Summer	Chihli ...... Honan ...... Shantung...	
1065	Spring ...	....	
1067	Summer Autumn	....	Of long duration.
1068	Summer Winter...	Chêhkiang	
1069	Spring ...	....	Great drought.

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1070	Summer Autumn	Chihli ...... Honan ...... Shensi	Land-tax remitted.
1071	Spring ...	....	
1072	Summer	Honan	
1073	Summer Autumn	....	
1074	Spring ... Summer Autumn	Chihli ...... Honan ...... Kiangsu ... Shantung... Shensi	Of long duration.
1075	Summer Autumn	Anhwei ... Chêhkiang Chihli ...... Hunan ...... Hupeh ...... Kiangsi ... Kiangsu ...	Great drought.
1076	Autumn	Chihli ...... Shansi ...... Shantung... Shensi	
1077	Spring ... Summer Autumn	....	Great drought.
1079	Spring ... Summer	Chihli ...... Shansi ...... Shantung... Shensi	
1080	Spring ...	Chihli ...... Shansi	
1082	....	....	
1083	Summer	Honan	
1086	Spring ... Summer Winter...	....	Universal and of long duration.
1087	Spring ... Summer	....	

Year.	Season of Year.	Provinces.	Remarks.
1088	Autumn	Honan	
		Shansi	
		Shensi	
1089	Spring	Chihli	
		Honan	
		Shantung	
1090	Spring	....	
	Summer	....	
1093	Autumn	....	
1094	Spring	Honan	No snowfall.
	Summer		
	Winter		
1096	....	Kiangsu	Great drought: rivers dried [up.
1097	Summer	Chêhkiang	
		Kiangsi	
1098	....	Kiangsu	
		Shangtung	
1099	Spring	Honan	
1101	Summer	Chêhkiang	
		Fuhkien	
		Hunan	
		Kiangsi	
		Kiangsu	
1102	....	Chêhkiang	
		Fuhkien	
		Hunan	
		Kiangsu	
1107	....	Shensi	
1108	Summer	Chêhkiang	Great drought.
	Autumn	Kiangsu	
	Winter		
1109	....	Chêhkiang	Land-tax remitted.
		Fuhkien	
		Hupeh	
		Kiangsu	
1111	Summer	Kiangsu	
1113	....	Kiangsu	
1114	....	Shantung	
1119	Spring	Honan	
	Autumn	Kiangsu	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1120	....	Kiangsu ...	
1122	Spring ...	Shantung ...	
1123	Summer	Chihli ...... Kiangsu ... Shantung ... Shensi	
1128	Autumn	....	Locusts.
1132	....	Kiangsu ...	Great drought.
1133	Summer Autumn	....	Of long duration.
1135	Summer Autumn	Chêhkiang Hunan ...... Kiangsu ... Sze-ch'wan	Of long duration.
1136	Spring ...	Hunan ...... Sze-ch'wan	Land-tax remitted.
1137	Spring ... Summer	Anhwei ... Kiangsi ... Kiangsu ...	Very severe.
1138	Winter...	....	
1139	Summer	....	
1141	Autumn	....	
1142	Spring ... Autumn	Kiangsu ... Shansi ...... Shensi	
1143	....	Shensi	
1148	Summer	Chêhkiang Kiangsi ... Kiangsu ...	Great drought. Land-tax remitted.
1149	....	Kiangsu ...	
1154	Summer	Chêhkiang Kiangsi ...	Land-tax remitted.
1157	Autumn	Sze-ch'wan	Land-tax remitted.
1159	Spring ... Autumn	Chêhkiang Kiangsi ...	
1160	Spring ... Autumn	Chêhkiang Kiangsi ... Shensi ...... Sze-ch'wan	Very severe.

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1163	Autumn	Chêhkiang Kiangsi ...	Great drought. Land-tax remitted.
1164	Spring ... Summer Autumn	Chêhkiang Fuhkien ...	
1165	....	....	Locusts and Floods. Land-tax remitted.
1167	Autumn	Sze-ch'wan	Very severe.
1168	Summer	Hupeh	
1169	Summer	Kiangsu ...	
1170	Summer	Chêhkiang Fuhkien ...	
1171	Spring ... Winter...	Chêhkiang Hunan ...... Hupeh ...... Kiangsi ... Kiangsu ...	Land-tax remitted.
1172	Summer	Chêhkiang Chihli ...... Fuhkien ... Kiangsu ... Shansi ...... Shantung... Shensi	Of long duration.
1173	Spring ...	Chêhkiang Fuhkien ... Hupeh ...... Kiangsi ...	Of long duration.
1174	....	Chêhkiang Hunan ...... Sze-ch'wan	
1175	Autumn	Chêhkiang Kiangsu ...	
1176	Spring ...	Chihli ...... Honan ...... Hupeh ...... Kiangsu ... Shantung... Shensi	Land-tax remitted. Locusts.

Year.	Season of Year.	Provinces.	Remarks.
1177	....	Hupeh	
1178	....	Kiangsu ...	
1180	Spring ... Summer Autumn	Anhwei ... Chêhkiang Hunan ...... Kiangsi ...	Great drought.
1181	Autumn	Chêhkiang Hupeh ...... Kiangsi ... Kiangsu ... Sze-ch'wan	Land-tax remitted. Floods.
1182	Summer Autumn	Chêhkiang Hupeh ...... Kiangsi ... Sze-ch'wan	
1183	Spring ... Autumn	Chêhkiang Fuhkien ... Hupeh ...... Hunan ...... Kiangsu ... Sze-ch'wan	
1184	Summer Autumn	Fuhkien ... Kiangsi ...	
1186	....	Kiangsi ...	
1187	Summer Autumn	Chêhkiang Kiangsi ... Kiangsu ...	Very severe.
1188	....	Anhwei ...	
1190	Summer	Sze-ch'wan	
1191	Summer Autumn	Anhwei ... Chihli ...... Hunan ...... Kiangsu ... Shantung ... Sze-ch'wan	
1192	Spring ... Summer Autumn	Sze-ch'wan	Great drought. Land-tax remitted.

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1193	Summer Autumn	Chêhkiang Kiangsu ... Sze-ch'wan	Great drought in Sze-ch'wan.
1194	Spring ... Summer Autumn	Anhwei ... Chêhkiang Kiangsi ... Kiangsu ...	Very severe.
1196	Spring ... Summer	Chêhkiang	
1197	Spring ... Summer Autumn	Sze-ch'wan	Great drought. Land-tax remitted.
1199	Summer	....	
1200	Spring ... Summer	Chêhkiang Hunan ...... Hupeh ...... Kiangsu ...	Great drought in Chêhkiang.
1201	Summer	Chêhkiang Kiangsu ... Sze-ch'wan	Great drought.
1202	Spring ... Summer Autumn Winter...	Chêhkiang Hunan ...... Kiangsu ...	Very severe. No snowfall.
1203	Spring ... Summer	....	
1204	Summer Autumn	Chêhkiang Chihli ...... Kiangsi ... Shantung...	
1205	Summer	Chêhkiang Fuhkien ... Kiangsi ... Kwangsi ... Kwangtung Sze-ch'wan	Great drought.
1206	Autumn	Chêhkiang Hunan ...... Hupeh ...... Kiangsi ...	Land-tax remitted.

Year.	Season of Year.	Provinces.	Remarks.
1207	Summer	Chêhkiang	
1208	Summer	Chêhkiang	Land-tax remitted.
1209	Summer	Chêhkiang Hupeh ...... Kiangsu ...	Great drought in Chêhkiang.
1210	Summer	Chihli ...... Shantung...	Great drought.
1211	Summer	Chihli ...... Shantung... Sze-ch'wan	
1212	Spring ...	Shansi ...... Shantung... Shensi	Great drought.
1213	Summer Autumn	Hupeh ...... Shensi	
1214	Summer	....	
1215	Spring ... Summer	Anhwei ... Chêhkiang Fuhkien ... Kiangsi ... Kiangsu ...	Locusts.
1216	Autumn	....	
1217	Autumn	....	
1218	Summer Autumn	Kiangsu ...	
1219	Summer	....	
1220	Summer	Chihli	
1221	Spring ...	Chêhkiang Fuhkien ... Kiangsi ... Kwangtung	Very severe.
1222	Summer Autumn	Chihli ...... Hunan	
1225	Summer	Chihli	
1226	Spring ...	Shensi	
1228	Summer	Chihli	
1233	Summer	....	Great drought.
1237	Summer	Chêhkiang	
1239	Summer	....	

Year.	Season of Year.	Provinces.	Remarks.
1240	Summer	Chêhkiang Fuhkien ... Kiangsi ...	Great drought. Locusts.
1241	Autumn	....	
1244	Summer	....	
1245	Summer Autumn	Kiangsu ...	Very severe.
1246	Summer	....	
1247	Spring ... Summer	....	
1251	....	Fuhkien ... Kwangtung	
1253	Summer	Fuhkien ... Hunan ...... Hupeh ...... Kiangsi ... Kwangsi ... Kwangtung	
1257	Summer Autumn	Chêhkiang	
1258	Spring ... Summer	....	Of long duration.
1260	....	Shansi	
1262	Summer	....	
1263	Summer Autumn	Chihli ...... Honan	
1264	Summer	Shansi ...... Shantung...	
1265	Summer	Chihli ...... Kiangsu ... Shansi ...... Shantung...	
1266	....	Shensi	
1267	Autumn	Chihli ...... Fuhkien ...	Great drought. Land-tax remitted.
1268	....	Chihli	
1269	Summer	Chihli	Land-tax remitted.

Year.	Season of Year.	Provinces.	Remarks.
1270	Summer Spring ...	Anhwei ... Honan ...... Kiangsi ... Kiangsu ... Shantung ...	Great drought. Land-tax remitted in Kiangsu, Honan, and Shantung.
1271	Summer	Chihli	
1272	Summer	....	Famine in Corea.
1273	Summer Autumn	....	
1274	....	Anhwei ...	Great drought.
1275	....	....	Great floods in Chihli, Honan, and Shansi.
1276	....	Shansi	Land-tax remitted.
1277	Summer	Honan ...... Shantung ...	
1278	Summer	Shansi ...... Honan	
1279	Autumn	Chihli	
1280	Autumn	Chihli ...... Shansi	
1281	Spring ...	Chihli ...... Shansi	Land-tax remitted.
1282	Autumn	Chihli ...... Shantung ...	
1283	....	Chihli ...... Shantung ...	
1285	Summer	Chihli ...... Honan ...... Shansi ...... Shantung ...	
1286	Summer	Chihli ...... Honan ...... Shansi	Land-tax remitted.
1287	Spring ...	Shansi	
1288	Spring ... Summer Autumn	Shantung ... Shensi	
1289	Summer	Shansi	Great drought. Insurrection in Hunan.

Year.	Season of Year.	Provinces.	Remarks.
1290	Summer Autumn	Chihli	Land-tax remitted.
1292	Spring ... Summer	Kwangtung Shantung ...	Floods.
1293	....	Chihli	Very severe.
1295	Summer Autumn	Chihli ...... Kansuh ... Shansi ...... Shensi	
1296	Autumn	Chihli ...... Honan ...... Shansi	Drought at Moukden. Land-tax remitted.
1297	Spring ... Summer Autumn	Chihli ...... Honan ...... Hunan ...... Kiangsu ... Shansi	Great drought.
1298	Spring ... Summer	Chêhkiang Chihli ...... Honan ...... Kiangsu ...	Locusts in Kiangsu.
1299	Summer	Hunan ...... Hupeh ...... Kansuh ... Kiangsu ...	Land-tax remitted.
1300	Spring ... Summer Autumn	Anhwei ... Chihli ...... Honan ...... Kiangsu ... Shantung...	
1301	Summer Autumn	Chihli ...... Honan ...... Hunan ...... Kiangsu ...	Floods. Land-tax remitted.
1302	Spring ...	Kiangsu ... Shensi	Land-tax remitted.
1304	Summer	Shensi	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1305	Summer	Chihli ...... Hupeh ...... Kwangsi ... Shansi ...... Shensi	
1306	Summer	Chihli	Great drought.
1308	Spring ...	Honan ...... Shensi	
1310	Spring ... Summer	Chihli ...... Kiangsu ... Shantung...	Locusts. Floods.
1311	Summer	Chihli ...... Shensi	Land-tax remitted. Floods.
1312	Autumn	Shantung...	
1313	Autumn	Chihli	Great drought. Typhus fever raged.
1314	Winter...	....	No snowfall.
1315	Spring ... Summer	Chihli ...... Kansuh ... Shantung...	
1317	Summer	Hupeh	
1318	Autumn	Chihli	Great drought.
1320	Summer Autumn	Hupeh	Floods at Moukden.
1321	Summer	Chihli ...... Kiangsi ... Kiangsu ... Shansi	Land-tax remitted.
1322	Spring ... Summer Winter...	Chihli ...... Honan ...... Kiangsu ... Shensi ...... Sze-ch'wan Yünnan ...	Half of land-tax remitted in Chihli, Honan, and Shensi.
1323	Summer	Chihli ...... Shansi	Great drought in Chihli.
......	....	....	
......	....	....	
......	....	....	

Year.	Season of Year.	Provinces.	Remarks.
1324	Spring ... Summer	Anhwei ... Chêhkiang Chihli ...... Honan ...... Hunan ...... Hupeh ...... Kansuh ... Kiangsu ... Kiangsi ... Shensi	Great floods in Chêhkiang and Chihli.
1325	Spring ... Summer	Chihli ...... Honan ...... Hupeh	Land-tax remitted.
1326	Summer	Anhwei ... Chihli ...... Honan ...... Kwangsi ... Shensi ...... Sze-ch'wan	Land-tax remitted. Locusts.
1327	Summer Autumn Winter...	Anhwei ... Chihli ...... Honan ...... Shansi ...... Shantung... Shensi ...... Sze-ch'wan	Land-tax remitted.
1328	Summer	Chihli ...... Honan ...... Kiangsu ... Shensi	Great drought and cannibalism in Shensi.
1330	Summer Autumn	Anhwei ... Chêhkiang Chihli ...... Honan ...... Hunan ...... Hupeh ...... Kiangsi ... Shantung... Shensi ...... Sze-ch'wan	Land-tax remitted. Locusts. Great drought in Mongolia. Cannibalism in Honan.

Year.	Season of Year.	Provinces.	Remarks.
1331	Summer, Autumn	Chihli ...... Honan ...... Shansi	
1332	Autumn	Chihli ...... Honan ...... Hupeh ...... Shansi	
1333	Summer	Chêhkiang Kiangsu ...	
1334	Spring ...	Chêhkiang Honan ...... Hunan ...... Hupeh ...... Kiangsu ...	Locusts. Drought at Moukden.
1335	Spring ... Summer	Honan ...... Shantung ...	Great drought.
1336	Spring ...	Chêhkiang Hupeh ...... Kiangsi ... Kiangsu ... Shensi	Great distress prevailed.
1340	Summer	Kwangtung	
1342	Spring ... Summer Autumn	Chihli ...... Honan ...... Shansi	Great drought. Cannibalism existed.
1343	Autumn	Hupeh	
1344	Spring ... Summer Autumn	Fuhkien ... Hunan ...... Kiangsu ...	Great drought in Fuhkien.
1345	....	Shantung ...	Great drought.
1346	....	Kiangsu ...	
1347	Summer	Honan ...... Shensi	Great drought.
1348	Summer	Chihli ...... Honan ...... Shantung... Sze-ch'wan	Great drought.
1350	Summer Autumn	Honan	

Year.	Season of Year.	Provinces.	Remarks.
1351	....	Kiangsu ...	
1352	Summer Autumn	Chêhkiang Hupeh	Great drought in Hupeh.
1353	Summer	Chihli ...... Chêhkiang Hunan ...... Hupeh ...... Kiangsi ... Kwangtung	Great drought.
1354	....	Fuhkien ... Honan ...... Hunan ...... Kwangsi ...	Great drought. Cannibalism existed.
1355	....	Honan	Great drought.
1356	....	Chêhkiang	Great drought.
1358	Spring ... Summer	Chihli ...... Shantung ... Shensi	Great drought. Cannibalism in Shantung and Shensi.
1359	....	Kwangsi ... Shensi	Great drought.
1360	Summer Autumn	Chihli ...... Kwangsi ... Shansi	Great drought.
1362	....	Honan	Great drought and cannibalism.
1363	....	Kwangsi ... Shantung...	Great drought.
1368	Spring ... Summer	Chêhkiang	Land-tax remitted.
1369	Spring ...	Chêhkiang	
1370	Summer	....	
1372	Summer	....	
1375	Autumn	Chêhkiang	
1378	....	Sze-ch'wan	Great drought and mortality.
1381	....	Chêhkiang	
1387	....	Fuhkien ...	Great drought.
1393	Summer	Chêhkiang	Great drought.
1403	....	Hunan ...... Kwangsi ...	Great drought.

Year.	Season of Year.	Provinces.	Remarks.
1405	....	Chêhkiang	[ed.
1416	Summer	Chêhkiang	Great drought. Typhus rag-
1423	....	Chêhkiang	Great mortality.
1426	Summer	Hupeh	Great drought.
1427	Summer Autumn	Shansi ...... Shensi	Granaries opened, and land-tax remitted.
1428	Summer	Shansi ...... Shensi	Great drought in Shensi.
1429	Summer	Shansi	Land-tax remitted.
1333	Summer	Chihli ...... Honan ...... Shansi ...... Shantung...	Land-tax remitted.
1434	Autumn	Anhwei ... Chêhkiang Honan ...... Hunan ...... Hupeh ...... Kiangsi ... Kiangsu ... Kwangsi ...	Rivers dried up.
1435	Summer	Hunan	Great drought. Typhus raged.
1436	Summer	....	
1438	....	Chêhkiang	
1440	Spring ...	Chihli	Great drought.
1442	Summer	Chihli	Great drought.
1444	Summer	....	
1446	Summer	Chihli ...... Hupeh	Great drought in Hupeh.
1450	Summer	....	
1451	Spring ... Summer	Fuhkien ...	Great drought.
1452	Autumn	Anhwei ... Chêhkiang Hunan ...... Hupeh	
1453	Autumn	Yünnan ...	Great drought and mortality.
1455	Summer	....	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1456	Summer Autumn	Anhwei ... Kiangsu ... Chêhkiang Hunan	Great drought.
1457	....	Chêhkiang	
1458	Summer Autumn	Chêhkiang Hunan ...... Hupeh	Great drought. Rivers dried up. Cannibalism in Hukwang.
1459	....	Hunan	Great drought.
1461	....	Hunan	Great drought.
1468*	Summer Autumn	Fuhkien ...	
1478*	Summer	Fuhkien ...	
1465	Spring ...	Shensi	Land-tax remitted.
1466	Spring ... Summer	Kiangsu ... Shensi	Great drought. Cannibalism existed.
1467	Spring ...	Kiangsi ...	
1468	Summer	Chihli ...... Hupeh ...... Kiangsi ...	Great drought in Chihli.
1469	....	Hunan	Great drought.
1470	Summer Autumn	Honan ...... Hupeh ...... Shantung...	Great drought in Hupeh. Land-tax remitted.
1471	Spring ...	Kiangsu ...	Grand canal dried up.
1472	Summer	Chihli ...... Kwangtung Shansi	Great drought in Chihli. Land-tax remitted.
1473	....	Hupeh ...... Shansi	Great drought in Hupeh. Land-tax remitted.
1474	Spring ...	Hunan ...... Hupeh	
1476	....	Fuhkien ...	Great drought.
1478	Summer	Hupeh	Great drought.

(*) There is evidently a mistake in the record of these two years. They appear as the 12th and 22nd respectively of the reign *T'ien Shun* 天順. The reign Ch'êng Hwa 成化 commenced in 1465.

Year.	Season of Year.	Provinces.	Remarks.
1479	Summer	Chêhkiang Hupeh	Great drought.
1483	Summer	Shantung... Yünnan ...	Great drought and Cannibalism in Shantung.
1484	Summer Autumn	Chihli ...... Honan ...... Hupeh ...... Shansi ...... Shantung... Shensi	Great drought and Cannibalism in Shansi.
1485	Spring ... Summer Autumn	Hupeh ...... Kiangsu ... Shantung... Shensi	Great drought and Cannibalism in Shantung and Shansi.
1486	Spring ... Summer Autumn	Chêhkiang Fuhkien ... Shansi ...... Shensi	Great drought and Cannibalism in Shansi.
1487	Spring ... Summer	Chêhkiang Chihli ...... Fuhkien ... Hunan ...... Hupeh	Great drought and Cannibalism in Hupeh.
1488	Summer	Chêhkiang Hupeh ...... Shensi	Great drought. Cannibalism existed.
1489	Summer	Hupeh ...... Sze-ch'wan	Great drought.
1491	Summer	Chêhkiang Hunan	Great drought in Chêhkiang.
1492	Spring ...	Shantung...	Great drought.
1493	Summer	....	Great drought.
1494	Winter...	Chêhkiang	
1495	Spring ... Autumn	Shansi	Great drought.
1497	....	Shansi	
1498	Summer Autumn	Chêhkiang Kiangsi ... Kwangsi ... Kwangtung	Great drought.

Year.	Season of Year.	Provinces.	Remarks.
1499	Summer Autumn Winter...	Fuhkien ...	Land-tax remitted.
1500	Spring ... Summer	Chêhkiang Yünan	Great drought in Yünnan.
1501	....	Fuhkien ...	Great drought.
1502	....	Kwangtung	
1503	Summer	Chêhkiang Chihli	Great drought.
1504	Spring ... Summer Autumn	Chihli ...... Shansi ...... Shantung...	People in Shansi devoured the bark of trees.
1506	Summer	Chêhkiang Hupeh ...... Kiangsi ...	Great drought in Chêhkiang and Hupeh.
1507	Summer	Hunan ...... Shensi	Great drought in Shensi.
1508	....	Chêhkiang Hupeh	Great drought.
1509	Summer	Hunan ...... Hupeh ...... Kiangsi ...	Great drought in Hu-Kwang.
1510	Summer	Sze-ch'wan Chihli	Great drought in Chihli.
1511	....	Hupeh	Great drought.
1512	....	Shansi	Great drought.
1513	....	Kiangsi ... Fuhkien ...	Great drought in Kiangsi.
1514	....	Hunan	
1515	Summer	....	Great drought and dust-storms.
1516	Summer Autumn	Hunan ...... Shantung...	Great drought in Hunan.
1517	....	Kwangsi ...	Great drought.
1518	Autumn	Hupeh	Great drought.
1520	....	Chêhkiang	
1521	Autumn Winter...	Chêhkiang	
1522	....	....	

Year.	Season of Year.	Provinces.	Remarks.
1523	Summer	Chihli ...... Honan ...... Hunan ...... Hupeh ...... Kiangsi ... Kwangsi ... Shantung... Yünnan ...	Great drought.
1524	....	Chêhkiang Yünnan ...	Great drought.
1526	Summer	Chêhkiang Fuhkien ... Kiangsi ...	Great drought. A meteor fall in Yung chun in Fuhkien, where it exploded and killed a number of people.
1527	....	Chêhkiang	Great drought.
1528	Summer	Chihli ...... Honan ...... Hunan ...... Hupeh ...... Shansi ...... Shantung... Shensi ...... Sze-ch'wan	Cannibalism in Hupeh and Shensi. Great drought.
1529	Spring ...	Chêhkiang	
1532	Spring ... Summer	Hupeh ...... Shansi ...... Shensi	Great drought.
1533	Spring ...	Shansi	Great drought at Moukden.
1534	....	Hupeh	Great drought.
1535	....	Anhwei ... Hupeh ...... Kiangsi ... Kiangsu ...	Great drought. Rivers dried up.
1536	....	Fuhkien ... Kwangtung	Great drought in Kwangtung.
1537	....	Fuhkien ...	

Year.	Season of Year.	Provinces.	Remarks.
1538	Summer	Chihli ...... Fuhkien ... Hupeh ...... Shantung... Shensi	Great drought.
1539	Spring ... Summer Autumn	Chêhkiang Hupeh	Great drought. Wells and rivers dried up.
1540	Summer Winter...	Hupeh ...... Kweichow	
1541	....	Chihli ...... Kweichow	Locusts in Chihli.
1542	....	Chêhkiang	
1543	Summer Autumn	Hunan ...... Kwangtung	Great drought in Kwangtung.
1544	Summer Autumn	Chêhkiang Kiangsi ... Hupeh	Great drought.
1545	....	Chêhkiang Fuhkien ... Hupeh	Great drought. Earthquake in Hupeh. Great mortality in Fuhkien.
1547	....	Hupeh	Great drought.
1550	....	Chêhkiang	Great drought.
1551	....	Hupeh	
1552	....	Kiangsi ...	
1553	....	Shensi	Great drought.
1554	....	Hupeh	Great drought.
1556	Spring ... Summer	Yünnan ...	
1557	....	Shansi	Great drought.
1558	Summer Autumn	Shansi	Of long duration.
1559	....	Yünnan ...	Great drought. Land-tax remitted.
1560	Spring ... Summer Autumn	Kwangtung Shantung...	Great drought.
1561	Spring ...	Chihli	

Year.	Season of Year.	Provinces.	Remarks.
1562	Spring ... Summer	Honan ...... Hupeh ...... Shansi	Great drought in Honan.
1563	Summer Autumn	Hupeh	Great drought.
1564	Spring ... Summer	Shansi ...... Yünnan ...	Of long duration.
1565	....	Hunan ...... Shansi	
1566	Autumn Winter...	Fuhkien ...	Great drought.
1567	....	Yünnan ...	
1568	Summer Autumn	Anhwei ... Chêhkiang Fuhkien ... Kiangsi ... Kiangsu ... Shansi ...... Shensi ...... Sze-ch'wan	Great drought.
1572	....	Shensi	Great drought and Canniba- [lism.
1573	Summer	Chêhkiang Hunan ...... Shantung...	Great drought in Shantung and Hunan.
1575	....	Chêhkiang Kwangsi ...	Great drought.
1576	Spring ... Summer	Yünnan ...	
1577	Spring ... Summer	Yünnan ...	Great mortality.
1578	Autumn	Fuhkien ...	Great drought.
1579	Spring ... Summer	Fuhkien ... Shansi	Great drought in Fuhkien.
1581	....	Chêhkiang	Locusts.
1582	....	Hupeh ...... Shansi ...... Shensi	Great drought. Cannibalism in Shensi.
1583	....	Shansi	Rivers dried up.
1584	Autumn	Kwangsi ...	Great drought. Land-tax remitted.

Year.	Season of Year.	Provinces.	Remarks.
1585	Summer	Shensi	Great drought. Land-tax remitted.
1586	....	Fuhkien ... Honan ...... Shansi ...... Shensi	Great drought.
1587	....	Fuhkien ...	Great drought.
1588	....	Hupeh ...... Kiangsi ... Kiangsu ... Yünnan ...	Great drought.
1589	Spring ...	Fuhkien ... Hupeh ...... Kiangsi ... Kiangsu ... Shansi	Great drought.
1590	Spring ... Summer Autumn	Chêhkiang Fuhkien ... Yünnan ...	Great drought in Chêhkiang.
1591	Summer	Fuhkien ... Yünnan ...	Great drought in Fuhkien.
1593	....	Chêhkiang Kweichow	
1594	Autumn	Kwangsi ...	
1595	Autumn	Kwangsi ... Shansi	Great drought in Shansi.
1596	Summer Autumn	Chêhkiang Kwangtung Shansi	Great drought.
1598	....	Chêhkiang	Great drought.
1599	Spring ...	Shansi	Great drought.
1600	Autumn	Yünnan ...	
1601	Summer Autumn	Chihli ...... Hunan ...... Hupeh ...... Kweichow Yünnan ...	Great drought in Hu-kwang.
1605	....	Chêhkiang	Great drought. Locusts.

Year.	Season of Year.	Provinces.	Remarks.
1606	....	Chêhkiang Fuhkien ...	Great drought. Land-tax remitted in Fuhkien.
1607	Summer	Shansi	
1609	Summer	Chêhkiang Honan ...... Hupeh ...... Shansi ...... Shensi	Great drought. Wells and rivers in Chêhkiang dried up.
1610	Summer	Shansi ...... Yünnan ...	Great drought in Yünnan.
1611	Spring ... Summer	Chêhkiang Shansi	Land-tax in Shansi remitted.
1613	Autumn	Fuhkien ... Shansi	Great drought.
1614	....	Fuhkien ... Hupeh	Great drought.
1615	Spring ... Summer Autumn	Chêhkiang Fuhkien ... Shansi ...... Shantung... Yunnan ...	Great drought and Cannibalism in Shantung.
1616	Spring ... Summer	Shansi	
1617	....	Anhwei ... Hupeh ...... Kiangsi ... Kiangsu ...	Great drought in Hupeh.
1618	Summer	Hupeh ...... Kwangsi ...	Great mortality in Kwang-si.
1621	Spring ... Summer	Yünnan ...	Great drought.
1622	Autumn	Hupeh	
1623	....	Kiangsi ...	Great distress.
1624	Spring ... Summer	Shansi ...... Kwangsi ...	Great drought. Insurrection in Hunan.
1625	Summer	Chêhkiang Shansi	
1626	....	Shansi	

YEAR.	SEASON OF YEAR.	PROVINCES.	REMARKS.
1628	Autumn	Chihli ...... Hupeh ...... Kwangsi ... Shansi	Great drought in Chihli.
1629	....	Shensi	Great drought.
1632	Autumn Winter...	Chêhkiang	Great drought.
1633	Autumn	Shansi ...... Shensi	Great drought. Cannibalism in Shensi.
1635	....	Shansi	
1636	Summer	Chêhkiang Kiangsu ... Shansi	Great drought.
1638	Autumn	Kiangsu ...	
1639	Winter...	Hupeh ...... Shansi	No snowfall.
1640	Summer	Chêhkiang Shantung...	Universal great drought and distress. Cannibalism in Shantung. Locusts in Chêhkiang.
1642	....	Chêhkiang	
1643	Summer	Chêhkiang Yünnan ...	Great drought in Yünnan.

ARTICLE IV.

SUNSPOTS AND SUN-SHADOWS OBSERVED IN CHINA, B. C. 28,–A. D. 1617.

By Alex. Hosie, M.A.,

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IT may not be uninteresting at a time when the theory has been promulgated that some connection may possibly exist between Sunspots and Famines, to place on record the dates of the occurrence of Sunspots and Sun-shadows observed by Chinese astronomers.

The first observation of these solar phenomena, according to the *T'u Shu Tsih Ch'êng*,* 圖書集成, was in the year B. C. 28; and, as will be seen from the accompanying tables, only one other instance is recorded anterior to the birth of Christ, namely, in the year 20. A reference to the third column of the tables will shew that these two phenomena have, together with the two afterwards recorded in the years A. D. 188 and 300, been classed as *black shadows* 黑氣 on the sun and not as *Sunspots* 黑子. The first observation of an undoubted Sunspot 日中有黑子† may be said to have been made in the year A. D. 301. From 301 to 1617, both inclusive, fifty-six observations of Sunspots and eight of Sun-shadows have been recorded; but there are long intervals which contain no mention of these solar phenomena. During the Yüan dynasty (1260-1367), for example, only one instance of their occurrence is recorded, namely in 1276; and during the following or *Ming* dynasty only four observations seem to have been made.

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* 庶徵典, Küan 17-24.

† *Jih Chung Yeo hêh tszc—lit.* In the sun there were black spots.

Solar *maculae* were first observed in Europe in the year 807*; and a reference to the accompanying tables will shew that in that year the same phenomenon was observed by Chinese astronomers. It is also stated that a Sunspot was seen by Averroes in the year 1161.† During the 8th moon of the year 1160 a solar spot is recorded to have been observed in China. This corroboration of the occurrence of these solar phenomena at so early a period is somewhat remarkable.

It is now generally admitted that the Chinese were the first to discover Sunspots. Arago says "Dans les 'Annales de la Chine' du Père Mailla, on lit qu'en l'an 321 de notre ère il y avait sur le soleil des taches qui s' apercevaient à la simple vue."‡ He goes on to say: "En prenant à la lettre les assertions du Père Mailla ......, les libres des Chinois......seraient de meilleur aloi." It will be found, however, that, although the first four observations recorded in the accompanying tables have been classed as black shadows on the sun, 黑氣, solar spots were seen in the years A. D. 301, 302 and 307.

Angry discussions have often taken plaee regarding the first discovery of solar spots by European astronomers after the invention of the telescope. That honour seems to rest between Fabricius and Galileo, both of whom are said to have discovered them independently early in the year 1611.§

The first publication on Sunspots appeared in 1611, and is entitled: *Joh. Fabricii Phrysii, de Maculis in sole observatis et apparente earum cum Sole conversione Narratio, et Dubitatio de modo eductionis specierum visibilium. Wittebergae*, 1611.‖ The work by Galileo on the same subject appeared in the following year.

It has been proved that there is a cycle of eleven years in the occurrence of Sunspots, but no proof has yet been forthcoming of a like cycle in the occurrence of droughts and consequent famines. Assuming the Sunspot cycle to the correct, we give here one or two instances of the concomitant occurrence of droughts. Sunspots were observed by the Chinese in the year 1160; and, according to the cycle, they should again be visible in the years 1171, 1182, 1193, 1204, 1215, etc. Now, it is recorded in the

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* 'Adelmus, a Benedictine monk, makes mention of a black spot being seen on the sun on March 17th, 807," Chamber's Astronomy, p. 8.

† Chamber's Astronomy, p. 8.

‡ Astronomie Populaire, Vol. II, pp. 107-8.

§ Chamber's Astronomy, p. 5.

‖ Arago, Astronomie Populaire, II, p. 109-10.

T'u Shu Tsih Ch'êng 圖書集成* that the province of Chêh-kiang suffered from drought in the years 1160, 1171, 1182, 1193, 1204 and 1215; that the province of Kiangsi was similarly affected in the years 1160, 1171, 1182, 1204 and 1215; and the province of Kiangsu in the years 1171, 1182, 1193 and 1215. It should be mentioned, however, that droughts have also occurred in the same provinces *within* these various cycles of eleven years.

The following tables may help to supply the blank that exists in European solar observations prior to the invention of the telescope.

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* 庶徵典, Kuan 89-96, heading 旱災.

Year.	Moon.	Remarks.
B. C. 28	3	Black shadows.
20	2	
A.D. 188	1	
300	1	
301	9	
302	11—12	
307	11	
321	2	
322	10	
342	1	
344	10	
345	3	
359	10	Size of an egg.
360	4	
361	2	
372	11	Size of a plum.
373	3, 11	Size of an egg.
388	2	Two spots. Size of plums.
389	6	
395	11	
400	11	
499	2	Three spots. Size of peaches.
501	8	
502	1— 2	Two spots visible.
509	8	Black shadows.
510	2	" "
513	1— 4	" "
577	11	
580	2	
807	10	
826	3	
832	3— 4	
837	11	Size of an egg.
840	2	Black shadows.
841	11	
865	1	Black shadows.
874	...	
974	1	
1077	2	Size of a plum.

YEAR.	MOON.	REMARKS
A. D. 1078	1,12	Size of a plum.
1079	2	" " " "
1104	10	Size of a date.
1105	10	
1112	4	
1118	11	Size of a plum.
1120	5	
1129	3	
1131	2	Size of a plum, visible four days
1136	10—11	Size of a plum
1137	2—4	" " " "
1138	2,10	
1139	2,10	
1145	6	Black shadows and spots
1160	8	
1185	1	Size of an egg
1186	5	" " " "
1193	11	
1200	2,12	
1202	12	Size of an egg.
1204	1	" " " "
1205	4	
1238	10	
1276	...	Size of a goose's egg.
1370	..	Spots were frequently observed during [this year
1511	5	Black shadow.
1529	2	" "
1617	.	

ARTICLE V.

THE ANCIENT LANGUAGE AND CULT OF THE CHOWS;

Being Notes Critical and Exegetical on the SHI-KING, *or Classic of Poetry of the Chinese.*

BY THOS. W. KINGSMILL,

President.

THE ordinary rendering of the Poetic Classic of the Chinese is so much at variance with what we know of the class of ballad poetry in other languages, and fits in so badly with what we can learn of the ancient history and traditions of the Chinese, that I have ventured the following notes as an attempt at opening a new system of criticism of Chinese texts. Geographical and ethnological investigations long ago led me to suspect a connexion between the early immigrants into China and the tribes of Central Asia, and thus induced me to study the external aspects of the language. The book of the Odes is undeniably of ancient date, and must be looked upon as a memento of the ballads once current in the empire of the Chows. Notwithstanding that as ballad poetry it must have been addressed to the ears of the listeners, it is absolutely incomprehensible when read in modern Chinese; nor is our understanding of it much furthered when we make use of the oldest of the dialects now extant, of which Cantonese seems to be the purest.

The paper is an attempt to clear up the difficulty, and to apply to the old language of China some of the principles of inflected speech apparently lost before the Odes were finally reduced to a written canon.

I shall begin with the first of the Odes, acknowledged to be one of the oldest in form and matter, and which offers several idiomatic expressions not to be explained by the present language.

Ode I. 1. i.

Where cry the ospreys
On the islet in the river
The best and fittest of women,
With *our* prince is well mated.

Close grow the sweet rushes
Swaying right and left to the current.
The best and fittest of women;—
Awaking he seeks her;
Seeks her, but finds her not:
Awaking he longs for her,
Anxious and excited,
Turning around till day's decline.

Close grow the sweet rushes;
Left and right he plucks them.
The best and fittest of women;—
With lute and harp he invites her.
Close grow the sweet rushes,
Left and right overspreading.
The best and fittest of women;—
With bell and tabour he makes her glad.

There is no doubt that the ode is older than the Chinese language as at present spoken; and according to the tradition noted lower down must have been carried into China by the Chows on their immigration. As the nearest analogue to Central Asian speech ten centuries before Christ I have ventured on a Sanscrit transcription of the first verse; and it is curious to notice the parallelism between it and the Chinese, which I have transliterated for the most part in Cantonese. I have at the end of the paper given the laws governing the interchange between the sounds of the ancient and modern languages; and it is worthy of note how closely those rules are observed between the two versions.

Chinese.	Sanscrit.
Kwan-kwan tsu-kiu	Kwa*n*ante çakunâh
Tsai ho-chi chow	Jalasya dâle
Yao-tiao shuk-nu,	Varish*t*â daksh*t*â,
Kiun-tsze hao-k'au.	Janiḳâ grahyate.

Every word in the first verse has thus its exact analogue; for though the words jal-as a river, Chinese 河 ho and dâl-as an island, Chinese chow 洲, do not occur in these forms the roots gal to

flow, whence apparently Gr. Ἄλυς, German *quell* and Sanscrit jal-am water; and dal to divide whence Lat. *dolo*, &c. are widely spread; the latter being represented in Chinese by the two forms 州 chow a province, a department, and 洲 a part cut off by water, an island, also written 島 tow with similar meaning.

The first line, it is strange to observe, has absolutely no meaning in modern Chinese, where kwan means to bar (a door) while the word t'sü kiu has similarly dropped out of the language since the time of the composition of the ode. Dr. Legge despairing of discovering any meaning renders the line as "*Kwan-kwan* go the ospreys"! Kwan is really a wide spread root signifying to *sing*, Latin *cano*, &c. The reduplicated syllable here apparently is a survival of the plural termination ant or anti. Similarly we look in vain in modern Chinese for the meaning of t'sü-kiu; tradition, however, makes it out to be one of the fishing hawks, and the description in the text of its making its home amidst the reeds which cover the islands in the rivers of China points to the osprey, *Pandion haliaetos.* The osprey is remarkable for its conjugal fidelity and love for its offspring, and hence we can understand the allusion in the text. But though the word has dropped out of Chinese it is to be found in Sanscrit, where we meet it in the çakunas, a name applied to the same class of birds, including the Indian kite, *Milvus Govinda*, and the Pondicherry eagle *Haliaetos Pondicerianus.*

In the second line the Chinese genitive particle 之 chi, in modern Chinese ti, seems to be a still surviving relic of the old genitive in sya, the locative has however to be represented by the preposition 在 tsai.

In the third line the phrase yao-tiao is peculiar to this ode and the second character 窕 does not seem to occur elsewhere. It seems therefore to be a compound word, and as 窈 yao, *good, modest*, &c. is to be compared with Sanscrit var-as with similar meaning, yao-tiao I have assumed as the representative of the old superlative varish*t*a, agreeing with its traditional meaning.

In the fourth line Kiuntsze a prince would literally be in Sanscrit janitar, but this form has in Sanscrit only the meaning of *genitor*: the allied form from the same root jan, janak-as, has however assumed a similar meaning to the Chinese, and has supplied to the Teutonic races their names for king.

The second verse conforms almost as closely to the Sanscrit idiom. Line 5, T'sam-chai, hang-tsai is as nearly Sanscrit *i.e.* "Sandheyâ rasâlah" close together *are* the sweet rushes (*arundo saccharifera*), and, as in the former case, the descriptive word rasâl-as has dropped out of the Chinese language and is only tra-

ditionally preserved, in connexion with this ode. The words will not bear the interpretation given by Dr. Legge. In line 8, Wu-mi, translated as two words waking and sleeping, a rendering in itself foolish, may be compared with line 3. 寤 wu usually rendered waking is again peculiar to the Odes where it occurs some five times, and always with the sense of *out*, as in I. 3. I. 寤辟 'tearing open' I. 3. v. 寤言 'calling out,' I. 14. IV. 寤嘆 'groaning aloud.' Mi originally meant, as we learn from the root in Sanscrit mîl, to blink, to wink, and hence *secondarily* to close the eyes, to sleep. With the affix ut, unmilâmi, it signifies to open the eyes, to awake. Here the word Wu seems to answer to the disjunctive Vi, with similar meaning, and the word in the original would have been vimîlya and the line have read Vimîlyo grahyati, as translated above. A play in the word K'au (or grah) is to be noticed signifying as 逑 *capere*, and as 求 *capture* both meanings being likewise attached to the root in Sanscrit. Line 9 would regularly read Grahyati viçakyati corresponding with the Chinese K'au-chi pat-tak 'seeks her but finds her not.' In line 10 again Sz-fuk 'longs for her' is to be compared with Sanscrit svad' to taste, enjoy. In line 11 Yu-tsai, yu-tsai is a phrase meaningless in modern Chinese, where no explanation can be given of the character 哉 tsai, looking at it as the representative of some word having originally a definable meaning we may compare it with Sanscrit virosh-as, *iratus*. In line 12 輾轉 Chin-chün may be taken as a frequentative form 'keeps turning' from a root tar or tarn, seen in Greek Τορνεύω, *tor-gueo*, &c. while fan-chak 'again declines,' not as translated by Dr. Legge again turns, may be assumed as alluding to the decline of day, 昃 and 側. chak, being both employed for the afternoon. The root of chak is connected with Sans. ta*n*ch of similar meaning.

Following the example of the first verse we may again transliterate in Sanscrit the second, with the exception of line 6 where the key seems lost.

CHINESE.	SANSCRIT.
T'sam-c'hai hang t'sai	San(m)-dheyâ rasâlah.
Tso-yu liu-chi.	
Yao-tiao shuk-nu ;	Varishtâ daksh*t*â ;
Wu-mi k'au-chi.	Vimîlyo grahyati.
K'au-chi pat-tak.	Grahyati viçakyati.
Wu-mi sz-fuk.	Vimîlya svadati.
Yu-tsai yu-tsai,	Viroshah viroshah.
Chin-chün fan chak.	Tor*n*yate punastanakta.

The third verse mainly repeats the refrain of the first and second, and offers but two new lines describing musical instruments, the equivalents of which I have not been able to trace in cognate languages, though the roots as before are Aryan. (*)

Having so far exemplified the form of the ballad and shown how close are its relations, not with modern Chinese but with the only ancient Aryan language of mid-Asia available for comparison, namely Sanscrit, it behoves us to enquire, whence this similarity? Is the ode a transliteration of a Sanscrit original carried bodily into China from without, as have been the formularies of the Buddhist church; or does it, on the other hand, contain a fragment of the ancient language of China; and is it to be considered as the fore-runner of the present degraded speech of China (using the term degraded simply in its geological sense, as referring to the absence of inflexions and polysyllables)?

We have no very definite grounds to go on, for the ode is not only, as I have stated, pre-Chinese but prehistoric, and I may add anterior to the use of written language. Of this latter fact there remains a curious record in the Tso-chuen which the author of the Shiki (Chapter XXXI) reproduces almost word for word. In the year 541 B. C. Yu-tsai, king of Wu sent his younger brother Ki-chat on a mission to the state of Lu for the purpose of hearing and studying the old ballads there preserved in the greatest purity, and which were the originals of the odes we possess in the Shi-king.

The extract bears internal evidence of being from another hand than the compiler of the Tso-chuen, and is excessively involved in style. Dr. Legge, following the Chinese commentators, gives a paraphrase rather than a translation of it (Chinese Classics V. 549-50). The bards at the court sang for the envoy a collection of poems corresponding with the present Shi-king and his comments thereon are given at length. He made them chant for him the Chow-nan and Shaou-nan, "Admirable," he remarked, "in their inception and rendering; there is nothing doubtful, "they stir one up without exciting anger." In a similar strain he commented on each part of the collection in turn. He then saw them posturing in the Siang-siao and the Nan-yûk "Ad-'mirably contrived," he said "yet withal sorrowful." They postured for him in the Ta-wû "Admirable indeed; here we have "a representation of the exuberant fancy of Chow." They then

(*) The K'im 琴 cfr. San. jambh *to bind*; the shat 瑟 San. çuch, *to grieve*, kuch, *to give forth a high sound*: ku 鼓 the *drum*, San. kal, *to beat, vibrate*.

displayed the Shao-hu; he remarked, "The magnanimity of the "sages is represented here; we have their self-conscious virtue "and their difficulties." They displayed the Ta-hia "Admir-"able indeed, stirring without pretence: except Yu, who could "have accomplished (the task)?" They performed the Chao-siao "Virtue," he said "and admirable greatness (is here ex-"hibited) as the overshadowing of heaven or the supporting of "earth. I doubt if the most perfect virtue could add anything "more; let the pantomime stop, if there be any more music I "shall not dare to look on." We are given to understand that two mimes more remained to be exhibited, that of Yaou and that of Hwang-ti. Ki-chat was so impressed with what he had heard and seen that he feared to proceed.

The description gives us a vivid view of the court of one of the petty princes of China. When the art of writing was in its infancy the traditions of the state were kept alive by bards and mimers. The picture writing which subsequently developed into the old character of the Shoh-wen was as yet too rude for any other purpose than the bald records of the Ch'un-t'seu. and the key to the decipherment of these was known but to a special class of men. It had in fact scarcely advanced beyond the stage of the *quipus* of Peru; it was an aid to the memory in the recollection of events, but not a representation of spoken language. Even so late as B.C. 529 we find the assistant historiographer of T'sû praised for his knowledge of the three Fun, the five T'ien the eight Sôk and the nine Kiu; yet even he failed when put to the test of an unfamiliar ballad.

To hear the ballads which a subsequent generation fortunately committed to writing before their echoes had finally died out, it was necessary to go to the court of Lû; which, boastful of its supposed descent from Chow-kung (Lord of the bright sky, literally *Dioscûros*), kept up, long after Chow had faded into insignificance, the ancient ballads and mimes in which the myths and traditions of the western conquerors were embodied.

We have no record of the time when the Book of Poetry was reduced to writing. Confucius speaks of learning the odes by heart 學, and of reciting them, 誦,* but in none of the books handed down from times antecedent to the Han dynasty, do we hear of their being written. Mencius tells us that when the traces of the sway of the Kings of Chow were extinguished, (Circiter B. C.

* Sung 誦 means to intone as the Brahmans did the Vedas or the Greeks the Iliad. It is the analogue of Sans. Svar or svri *recitare (hymnum.)*

770) the art of ballad-mongering was forgotten 亡, and annals came into vogue; he speaks of reading books 讀書, but of repeating the odes 頌 or 誦詩. This brings us down to at least 300 B. C., Mencius dying 288 B. C., thirty-two years only before Chao Siang assumed the rule of Chow, and seventy-five before the edict of Shi Hwangti for the destruction of the ancient records. The intermediate years were the most troubled that China has seen, and we have few, if any, contemporary literary remains.

On the whole it is by no means improbable that the odes took their present shape only after the accession of the Hans, when the scholars of the Empire set themselves to collect the scattered remains of the Chows. This was some ten centuries after the time traditionally fixed for the immigration of the Chows, and during this time they had spread themselves over a great part of Northern China, and had either by conquest or alliance absorbed the aboriginal inhabitants. The latter process could not but have resulted in a great alteration in the speech of the immigrants, not unlike in its nature the change wrought in England from the Norman French of William the Conqueror, or the Anglo-Saxon of Alfred to the English of Henry III.

Bearing in view these facts, we may account for many of the peculiarities of the Odes on the hypothesis that when they were composed they were in an inflected tongue, and the inflections were necessary not only to rhythm but to sense. By degrees inflections dropped out of the ordinary language, but the odes being looked upon as a heritage more or less sacred, their preservation was committed to a special class of men. To preserve the rhythm it was necessary to hand down the inflexions, but as their meaning became lost unintelligible sounds alone remained. These gradually became more and more corrupt, and reduplications and empty syllables, the hü-tsze 虛字 of the Chinese took their place. When the odes finally came to be written down nothing but faint tradition remained of their original form, and hence the strange medley presented by some of the older songs, especially in the Chaou-nan. Still, as the English of Henry III. preserved mainly its original roots, divested in great measure of the inflections of the old Anglo-Saxon, so the Chinese of to-day still preserves to a large extent the roots of the antique speech brought by the Chow immigrants into the T'ien-hia.

Nor is such a conclusion inconsistent with what we know of similar collections elsewhere. The Vedas are a case in point. The poems of the Rigveda are allowed by the best philologists an antiquity of some 1500 years before Christ, and on similar authority the introduction of writing into India is said to have taken

place not more than 300 years B. C. either Babylonia, or Arabia by way of Ceylon, being supposed to have been the route by which it travelled.* It seems certain from contemporary records that the Vedas did not exist in writing at the time of Alexander's visit B. C. 326; for so long a period were the olden poems of India handed down by oral tradition; and not the poems alone but chapters of comments, such as the çrutis and smritis. "Writing" says Professor Max Muller, "was practised in India before the time of Alexander's conquest; and though it may not have been used for literary purposes, one can hardly doubt that a written alphabet was known during the greater part of the Sûtra" (†) Max Muller however allows a higher antiquity to the introduction of writing than most recent writers, and he acknowledges that writing was not employed even in Alexander's time for literary purposes.

A similar state of matters with regard to writing is to be noticed in China. The oldest written record, the Ch'un ts'iu, scarcely contains, even as now existing, a thousand characters. In the time of Confucius it required the skill of an expert to disentangle the meaning from the old tablets. Nor was he himself in much better plight; his comments on the tablets were handed down orally to his disciples, nor was it for more than a century after his death, probably in the 4th century B. C. that they were collected into the Tso chuen 左傳 'Assisting narrative,'—not the narrative of Tso, as the myth-makers, who have invented *ad hoc* a sage Tso K'iu ming, would have us believe.

These considerations all tend in favour of the proposition that the odes as we now possess them are fragments, broken indeed, but still genuine fragments of the old speech of the settlers in China, and this brings us to the second portion of our subject; the meaning and intention of the poems.

Dr. Legge has here been done good service; he has carefully collected and collated the opinions of the Chinese commentators, and placed them in a tangible form for the perusal of the student. Although philologically the opinions of the commentators are little worth, they in their turn have preserved for us many old traditions, of the meanings and connexions of which they themselves had not the faintest idea. To one of these, the rendering of the bird T'sü kiu in the first line I have already alluded.

According to persistent tradition the poem celebrates the loves of king Wan (Man) and his consort T'ai-sze; and this leads on to

(*) "Academy," Vol. XI, 139, 579.

(†) History of Ancient Sanscrit Literature, p. 515.

what seems the proper interpretation of the ode. King Man (as I have shown) * fills an important part in the dawn legend of the Chows. He was the son of Ki-lîk 季歷 *i.e.* Glaukos, the Gleaming, and T'ai-yam, *i.e.* Saramâ the Dawn, and his individual name was C'hang 昌 *i.e.* Sûra, the Resplendent. T'ai-sze, his consort, according to the ordinary rules of phonetic change, would in the old language have been pronounced Sar-as; and this takes us to one of the most widespread of the names of the Dawn from the root sar, *to go* or *creep*, and which we recognise in Saramâ, Saranyû, Helênê, &c. T'ai-sze as the Odes tell us (III. 1. II.), came from Sin 莘 *i.e.* Ush-as, Aur-ora. It is the old story; as Helen ran off to Troy and Saranyû fled away from Vivaswat, so T'ai-sze disappears at the first sight of her husband. "Waking up he seeks her; seeks her, but finds her not" C'hang comes to woo his bride as Kephalos to woo Prokris, but like Prokris when the day-light comes she is nowhere to be found, and Man seeks for her, but in vain till evening brings her back again. Like Helen and Saranyû T'ai-sze becomes the mother of the twins, Wu-wang and Chow-kung, the latter name being the exact rendering as near as Chinese will permit of Dioskûros; nor does her progeny end there, for the Ta-ya speaks of her as the mother of a hundred sons, and from her most of the rulers of the petty states of the house of Chow claimed descent.

Such is the interpretation which comparative philology leads me to place on the first of the Odes; and in this it concides with the myth as developed in the Ta-ya, the Epics as we may call them of Chow. The ode Ta-ming (III. 1. II) sings of the wedding of Man with his bride; she comes from 莘 Sin, *i.e.* Ushas, the Dawn-land; she is the young sister of Indra, 俔天之妹 In-t'ien-chi mui (Sans, Indrasya m*r*ilayâ); her husband meets her at the Wei, a constellation (Musca, Bharinî,) as well as a river, to which the boats, or the clouds, serve as a bridge.

If we accept this rendering, we have a new light at once thrown on the Classic of Poetry, which places it in a very different calegory from the prosaic and artificial production it has generally been assumed to be; and we can the better understand the estimation in which it was held by Confucius, as handing down the old cult and traditions of the ruling race. Looking at the Odes as usually rendered it is difficult to discover under what conditions a race could have been found to compose; and more extraordinary still to remember such unmeaning utterances, which in their present form could never have been intelligible to the ear. We are, more-

(*) Legend of Wên Wang, Journal N.S., VIII, p.p. 23 and seq.

over, asked to believe, contrary to all the evidence of antiquity, that they were written down as a *tour de force*, a sort of literary juggle in fact, in place of being, as Mencius leads us to infer, remains of the prehistoric and pre-literary period when ballads and mimes were the only means available for handing down to posterity the great deeds of the founders of the Chinese polity.

Almost identical with the Kwan-tsü is one of the latter odes of the Chow-nan the Tsih p'o (I. 12. x.), and the resemblance pervades the entire of the composition both in form and meaning, extending even to minute details. Before transliterating the Chinese we may notice the similarity of ideas in the two.

ODE I. 12. x.

On the bank by the mere
  Where bloom the lotus flowers,
There is the beloved one.
  I am pained; but for what?
I wake up but for nought,
  My tears fall like rain.

On the bank by the mere.
  Where blooms the valerian,
There is the beloved one;
  Fittest and brightest of women!
I wake up but for nought,
  My inmost heart is distressed.

On the bank by the mere
  Where blooms the nelumbium,
There is the beloved one;
  Fittest and most charming of women!
I wake up but for nought,
  And keep turning on my pillow.

The latter ode is said to be one of those of the petty state of Ch'in close to the head-quarters of the Chows in Honan. History does not tell us much of this state, and it soon faded into utter insignificance. It seems strange that neither Chinese commentators nor Dr. Legge should have noted the identity of the diction with that of the Kwan-tsü; but in their minds there could be only one T'ai-sze, and while they tell us with regard to the Kwan-tsu that it "celebrates the virtue of the bride of king Wan," they find in the latter an expression of the manners of the State, which we are gravely informed "must have been frivolous and lewd"! Such is the value of Chinese criticism, and such the stuff which has hitherto passed current for profound knowledge!

We may pass on to transliterate the ode as we have done the Kwan-tsu, and their similarities will become, if possible more striking.

CHINESE.	SANSCRIT.
Pi châk-chi po	Sekasya pâre
Yu-p'u-yü ho	Yutra phallate kuvalah
Yu mei-yat-jen	Asti mrilayaikâ
Shang-yu-chi ho?	Dirnyâmi kimarthah?
Wu-mi wu-wei,	Vimilâmi vrithâ
T'ai-sze p'ang t'o.	Daçruvah vrishanti.

The scene which in the former ode was laid in an islet in a river is here removed to the bank of a mere, in Chinese 澤 châk, in the fourth lower tone, and hence the analogue of the Sancrit root sich, *humectare*, *effundere*; in Chinese the word has the verbal meanings of to *moisten*, *soften*, *fertilize*. The nominal form in Sanscrit sek-as means *irrigatio* rather than *lacus*, but the step is not far. In the second line I have taken 蒲 p'u as a verb rather than a substantive. In the fifth the phrase *wu-mi* explained above in connection with the first ode reappears with similar meaning. In the sixth t'ai-sze is to be taken as one word. I am not aware of the latter portion of it 泗 sze, which the commentators would have us read as *mucus*, occurring alone. T'ai-sze is thus the analogue of a form daçru, corresponding to Greek *δάκρυ* 滂 p'ang means *great rain* the equivalent of Sanscrit vrish, *pluere*, and the t'o is merely enclitic, representing the lost inflection.

In the tenth line again we have almost a reproduction of the refrain of the first ode, Yao-tiao shuk-nü, occurring this time as Shikta ch'e kun *i.e.* Dakshtâ Kanyâchâ "Fittest and brightest of women." The phrase in the sixteenth line being slightly varied Shik-ta ch'e îm *i.e.* Dakshtâ ramâchâ "Fittest and most charming." The last line contains the same phrase as line 12 of the first ode 輾 轉 Chin-chun "keep turning." The legend of the house of Ch'in 陳 will readily explain how the same myth reappears. The first ruler, we learn was duke Hû upon whom Wû-wang the son of the lady T'ai-sze bestows his own daughter, T'ai-ki 大 姬, in marriage. Ch'in was really a scion of the Chows and preserved with slight differences the olden language and traditions.

As we proceed onwards through the collection we shall find the same features continually presented, and be struck by the evident un-Chinese character of the diction. The second Ode of the

Chaou-nan is a case in point where a reference to the older language serves to give sense to what as usually translated is almost unmeaning. Transliterated as before the two first lines may be read.

Chinese.	Sanscrit.
Köt-chi t'am-hi	Kuçah strinmahe
Shi-yu-chung kuk.	Dasha*n*t*am ku*n*je.

Literally "We strew the kusa grass, growing down in the valley." The allusion being to strewing the sacrificial grass in front of the offerings that the dresses of the offerers might not be soiled (verse 3, line 4.)

We may even take some of the odes of later date and find the same peculiarity of diction, though in a less marked degree. The Hing-wei (III. 2. II.) describes a primitive feast where rulers and people have assembled together. Its first lines may be transliterated:—

Chinese.	Sanscrit.
Tun-pi hang-wei	Tanvanti rasâlâh
Niu-yang mat tsîn-li	Gâyâr mâ dhûnitavyâh
Fang-paou fang-t'ai	Punah palatâs * arthân
Wei yip nî-nî.	J*r*imbha*n*e-riddhân.

Wide spread the rushes;
Let not the cattle tread them down,
Again they push forth their sprouts
And flourish luxuriantly.

When we, however, leave the Chaou-nan and arrive at the Ta-ya and Siao-ya, the greater and lesser Epics, we find with a fuller growth of legend a greater development of the mythological element. The Siao-ya largely consists of hymns composed during the fierce struggle of the Chows with their inveterate enemies the Hîm-wan, better known by their subsequent appellation of Hiung-nû, apparently a Turkish tribe calling themselves Kara Nîrus. The strife was one of life or death, for the Turks were forced onwards by the strange infatuation which finally impelled them after many unsuccessful attacks on China to turn westwards, and overrun the entire of Central Asia and even to penetrate into Europe. Such periods have ever been fruitful of poetic inspirations, and the struggle for existence of the Chows offers no exception to the rule. Fortunately we have many of their battle

* Pal-as *stramen* the equivalent of Chinese 苞 pao *id. Cfr.* Lat. *palea*, Sans palâk-am *folium.*

songs handed down, and we are able to form some idea of the straits to which the nation was reduced. The T'sai k'i (II. 3. IV.), composed apparently in the eighth century B. C. when the Turks poured down on the old capital, which they finally succeeded in capturing, will serve as an instance. Dr. Legge sees in it only the record of an expedition against the tribes of the south under a leader called Fang-shuh, but as he stumbles over the very first line we shall let the ode speak for itself:—

ODE II. 3. IV.

Few were our words as we gathered the thistles;
In our fields overrun with brambles, *
In our acres reduced to jungle.
May Fang shuk descend, †
With his chariots three thousand,
And his warriors well trained!
May Fang-shuk be our captain,
In his chariot with the four speckled steeds,
His four steeds speckled and winged!
Roseate is the track of his car
Ornate his traces as fish scales.
Embroidered the reins and breast bands.

Few were our words as we gathered the thistles,
In our fields overrun with brambles;
In our ruined villages. ‡
May Fang shuk descend,
With his chariots three thousand,
And his pennons fluttering!
May Fang shuk be our captain!
The naves of his wheels all golden,
His eight bells clanging,
His garments well ordered,
His scarlet greaves resplendent,
His jewelled pendants tinkling around him!

As swoops the swift falcon,
Circling high in the heaven,
Straight down on its quarry;

* 薪 and 新 are identical in their original meaning, implying brushwood, fit only to be cut down.

† 涖 *li* to descend run down, as water. The phonetic points to orig. *lap*, with which compare Sans. lamb, Lat. *lab-or*.

‡ 中鄉; contrary to the genius of the language Dr. Legge translates 中 as a preposition; it really is a participle meaning finished, *cfr.* 央

So may Fang shuk descend,
With his chariots three thousand;
And his warriors well trained!
May Fang-shuk be our captain!
Call out the men; beat the drums;
Draw up the army; range the battalions!
Glorious truly is Fang shuk!
Roll the drums,
Urge the battalions to the fray!

Stealthily come the Mâns of king,
Challenging our great country.
Fang shuk is venerable amongst the ancients;
Lusty and vigorous are his ways.
May he be our captain;
May be capture and harry the hated ones!
Eager are his war chariots;
Eager and fiery.
Like the thunder and lightening,
Glorious truly is Fang shuk!
May he punish the Him wan;
May the Mâns of King come submissive!

The Shû-king (Canon of Yaou) tells us that in ancient times Yaou was called Fang-hun; but by the ordinary rules of phonetic change we learn that *fang* in the older language was pronounced *far* (*) and Far-hun or Varuna remains as the name by which Yaou was known to the ancients. I have endeavoured (*Celestial Empire*, Vol. , p.) to shew how the story of the Emperor Yaou really proceeded from the myth of Varuna. It is noteworthy that no mention of Yaou or Shun occurs under these names in the Classic of Poetry, yet if the story had been developed at the time the poems were composed it is impossible to explain the omission. There is no lack of allusions in the Odes to How-tsik, whom we may as the ancestor of the Chows identify with the Vedic Daksha. Later tradition tells us that How-tsik was the minister of agriculture to the Emperor Shun, yet strangely, though the myth of How-tsik from his birth onwards is developed in the Odes, not one single allusion is to be found to Shun. The pretended history of the Hia and Shang dynasties was a thing which when the odes were composed had as yet no existence. The accompaniments of Fang-shuk "Uncle" Fang show how little human there is about him. His three thousand chariots

(*) So 方 fang *four-square* agrees with forms like fidvor, &c.

with hosts of warriors are the celestial accompaniments of Varuna in the Vedas; while his winged and speckled steeds, the roseate track (路車有奭) of his car, the golden naves of his chariot and his scarlet garments tell of no earthly general. He is asked to descend 涖 as the falcon swoops from heaven on its prey; he is venerable among the ancients 元老; as the thunder and lightening are his war chariots; the most suitable description to be applied to him is 顯 hîu the effulgent (*cfr.* Sans indh *lucere, flagrare*). All these aid us in identifying the Fang-shuk of the ode, with the Fang-hün of the Shû-king, and through him with the Varuna or Uranus of other branches of the family.

With regard to the suggestive that Fang-shuk was a leader of the troops of Chow engaged in an expedition against the people of King (Hu-kwang) it is sufficient to say that the earlier historians of China saw no such intention in the poem. The Lûn-yu which details many supposed conversations of the period under review is silent as to Fang-shuk; and Sz-ma T'sien who carefully sought all the fragments of history available for his work the Shi-ki, and who was well acquainted with the Odes, makes no allusion to such a leader in his account of the strife between the kings of Chow and the K'iuen jung.

Assuming then that the ode is an ancient hymn to Varuna praying for his help when human aid was of little avail, we have a clearer understanding of the peculiar language made use of, and can well reconcile it with what we learn in other quarters of the condition of the state when the crimes of king Yu, the Dark, reduced China to the verge of ruin.

Nor is it difficult to account for the original intention of the ode having fallen into oblivion, for the same phenomenon happened with regard to Varuna or Uranus in India and Greece. Hesiod in his Cosmogony sings of the supercession of Uranus by his son Zeus, and we know that in India Varuna was already in Vedic times paling before the rising glory of Indra, the T'ien of the Chinese. In China although the pantheistic writers of the later Chow period could not altogether get rid of the remembrance of the older Varuna they succeeded in ousting him from his seat amongst the Shang-ti 上帝 or *dii superi*; and made of him by a misrendering of the character 帝 the earthly sovereign of a fabulous dynasty, the Hias.

The same strain we shall find developed in the other odes of the book; the Tsih-nan-shan (II. 4. VII.) is an invocation addressed under similar circumstances to Sze-yin 師尹.

Ode II. 4. vii.

Let us ascend (*) the southern hills,
  Precipitous though their rocks.
Glorious are you Sze-yin;
  The people turn their eyes to you,
Their hearts burn with grief,
  They dare not use pleasant words,
The state is utterly ruined;
  Why do you not behold?

Let us ascend the southern hills,
  Difficult though their steeps.
Glorious are you Sze-yin;
  Why shine you not with equal light?
Heaven keeps threatening (†) us;
  Ruin and disorder prevail around;
No words of gladness come from the people;
  Harried, they cannot repress their murmurs

Sze-yin, Lord of the Dawn (‡)
  Of Chow the foundation!
Preserve the equilibrium of the state;
  May our borders be protected;
May Indra be our helper!
  Grant that our people be not dispersed;
That they complain not against High Heaven;
  Unjustly abandoned by our Lord!

These complaints are continued through the remainder of the ode, without however again introducing the name of Sze-yin. In line 21 the phrase 天子 T'ien-tsze occurs, in antithesis to the words used in the next verse for the king 君子 *i.e.* janitar (see my remarks *s.v.* in the Ode I. 1. i.) It seems doubtful whether the phrase occurs in the Odes in its modern use of king or emperor.

The Sze-yin of the ode according to the commentators was a minister of the king of Chow, and the ballad is supposed to be a complaint of his ill conduct. The same objections are however to be made to this explanation as to that with respect to Fang-shuk,

(*) 節 Tsit, a node, a limit, may be compared with Sans *ritu*, Lat *art-us*, *ritus* from root *ri* *movere*, *dirigere*; whence also riti, *itio*, *via*. It seems here to bear the latter meaning.

(†) 薦瘥 Tsin' ,t'so, a frequentative form; *cfr.* Sans charch, for charchar, *minare*.

(‡) 尹氏大師 I have translated as if the two first characters were inverted, Yin-Sze T'ai-sze.

namely that the historians who lived nearest to the time of the Odes took no such meaning out of it, and did not weave the story into the body of their history, though willing enough to accept myth for history when the mythological nature of the story had been forgotten. We have therefore to look elsewhere for Sze-yin and fortunately in this as in the case of Fang-shuk we find him in the Shû-king.

The story of the rise of the Shâng dynasty repeats in its details that of the Chows. The house of Hia at last comes under the rule of 桀 Kit (*i.e.* the Night; *cfr.* Gr. σκοτός, Sans chhâyas *umbra*, chhad *tegere*), married to Mê-hi the Cloud; (*cfr.* Sans Megh-as.) Against him T'ang (*i.e.* Sûr-a the Resplendent) protests, but his complaints are not listened to, and he is shut up in prison. Obtaining his release he employs 伊尹 I-yin as the messenger between light and darkness; five times he goes backwards and forwards, till finding his task hopeless he persuades T'ang to raise the standard of rebellion. The same story reappears in turn when Shang is to give place to Chow. Ch'ow, the Hated one, marries Tan-ki (Gr. θνήσκω, θάνατος); the iniquities of Kit are repeated until the indignation of Ch'ang (identical with T'ang) is aroused. Ch'ang is imprisoned like T'ang but escapes, raises the standard of rebellion, and finally his son Fat (the Shooter-forth) establishes the new dynasty of Chow. Under similar circumstances and surrounded by similar myths the reign of Chow finally expires. The ode tells of its latter days and we need feel no surprise at the reappearance of Sze-yin or I-yin for the two are phonetically identical.

The story of T'ang gives us some insight into the part played by I-yin, and we have little difficulty in identifying him with the Dawn-son, Sarameya the Ἑρμῆς of the Greeks. Like Hermes he could not get rid of suspicion; as Hermes stole and cooked the oxen of the Sun, so I-yin has to be defended by Mencius from the charge of ingratiating himself with T'ang by his skill in cookery. He came in the suite of T'ang's bride, and brought with him (so runs the legend) the instruments of his craft, that by "cutting and cooking" he might make his way into the favour of his new lord. The unstable character of Sze-yin is more than hinted at in the present ode; 'Glorious he was, of Chow the foundation,' yet the people have to remind him that his fitful absences are fraught with danger to the state.

The hymn to Sze-yin, Sarameya or Hermes for all three are phonetically identical, as well as similar in their attributes, naturally carries us to the strange legends which surround the fall of the regal power of Chow: and here we begin to find ourselves on

the borders of history. The fall of Haou and the removal of the capital of Chow to Lok in Honan is referred to the year 770 B. C. or just fifty years before the beginning of the records of the Ch'un-t'siu. The bare facts of the capture and removal of the capital; of the internal disorders of the kingdom and the invitation to the K'iun-jungs, afterwards known as the Hiung-nû, and their ready acceptance of the proposal; of the death of the king and the destruction of the royal house; of the interference of T'sin and the partial re-instatement of the line of Chow, never afterwards, however, to be of any account amongst the other states, may all be accepted as historical. Around the simple tale has however gathered a mass of myth and legend; of strange commotions on earth, and unwonted signs in heaven, the beginning of which we can trace in the odes of the Siao-Ya; and which we find culminating in works like the Lieh kwoh-chi, a translation from which by the pen of Mr. H. Kopsch appears in the IVth volume of the *China Review*.

As I said above the myth was a reproduction of the old story of the fall of Hia and Shang. The rule of Chow has descended to the wicked and incapable Yû the "Dark" (Sans. val, *tegere*); Yû is married to a virtuous wife, but discards her in favour of the infamous Pao-sze (Sans. Prî-ti, Desire); his wife's father calls in the K'iun-jung who put an end to the old rule of Chow. The boys in the days of King Siuen, the father of Yû, sang through the streets a ballad of unknown origin but which the astrologers of the court pronounced prophetic.

"As the moon becomes larger
The sun gets smaller
By *Ya* bows and *Ki* quivers
The Chow dynasty will fall."

The means adopted by King Siuen to guard against the threatened result really brought on its fulfilment; he interdicted under penalty of death the possession of the dangerous weapons. One day a countryman and his wife in ignorance of the interdict, brought some of the forbidden arms into the capital for sale. The woman was seized and beheaded; the man escaped. Wandering alone by the banks of a river and lamenting his loss, he heard, as he thought, the cry of a child proceeding from a bundle of reed matting. He drew it out and found a female infant; he took her to to the city of Pao and gave her to a woman to nurse, who called her Pao-sze. Now it so happened that Pao-sze was of no mortal birth; her mother, a helping maid in the palace, had conceived her in some mysterious way, and had remained forty years enciente; when at last the babe was born the queen looking upon her as

uncanny had ordered her destruction, and she was thrown into the river to drown. Saved by the countryman she grew up a beauty as marvellous as her birth, and was purchased by one of king Yû's officers to place as a bride in the royal harêm. The king became enamoured of the dangerous beauty, dismissed his queen, banished the rightful heir and made Pao-sze his consort. Still she could never smile, and the infatuated king wasted his own and his subjects substance in efforts to produce a laugh. His efforts were at last successful; he lighted the signal fires and the vassals of the kingdom thinking it was invaded by the Jungs hastened to the rescue. But Pao-sze's smile had a bitter result; the disgraced queen's father enraged at the insult called in the Jung; again the signal fires were lighted but this time without result, for the vassals disdaining to be made sport of for Pao-sze took no notice; the capital was captured, the king murdered and Pao-sze became the concubine of the victor. Vengeance soon followed, the queen's father finding his allies not disposed to leave their prey called in the aid of T'sin who defeated in turn the Jung now sunk in debauchery, and Pao-sze to avoid a worse death strangled herself.

Such is the myth of Pao-sze; but the fall of Chow was presaged by extraordinary natural phenomence. Mount K'i the ancient traditional home of king Wan fell down, the three rivers of the old state were dried up, and fire and pestilence destroyed the people. The sun was eclipsed, and sun and moon seemed to the terrified minds of the people to have become of diminished size. All things in fact were tending to one end, and the lamentations of the Siao-ya increase in depth.

The last ode quoted wailed at the inconstancy of the Dawn-son Sze-yin, and we need not wonder that the other celestial bodies seemed in their courses to fight against the doomed kingdom. The street ballad of the boys seems to find its explanation in the Shap-yût-chi-kiao.

ODE II. 4. IX.

At the conjunction in the tenth month
  On the first day, by name *sin-mao*
The sun was eclipsed——
  A thing of very evil omen;
That the moon should become small,
  And the sun become small,
Henceforth the lower people
  Will be in but evil case.
The sun and moon presage calamity

In leaving their proper course:
The four states are without a head
From neglecting proper measures.
That the moon should be eclipsed
Is of little moment;
But that the sun should be eclipsed
What evil does it forerun;

Brightly flash the lightenings
There is turmoil without restraint;
The streams bubble and overleap their channels.
The hill tops fall down;
High cliffs become valleys;
Deep valleys are raised to hills.
Alas for the people of the age!
How is it that there is no one to retain our distress?

Jupiter rises to his culmination;
Pariçara follows close.
Kapuja is in the ascendant:
Sravana hurries by.
Savitra moves within
Ketu spurs his horses
Bharani leads the host
And the fair *Dhruva* flashes from her place

As for this Jupiter
Shall I say that he appears out of season?
What is it we have done
That he consorts not with our plans?
(The rain) has permeated our walls and dwellings
Our fields are reduced to mire and moor,
Yet he says he is doing us no injury
It is in accordance with settled laws.

皇父 Hwang-fu appears again in III. 3. IX. in connection with Namchung, the latter being likewise mentioned in II. I. VIII. where he is invoked to smite the Si-jung. In neither case is much left by which to identify Hwang-fu: he is spoken of in both cases as 鄉士, an obscure title apparently connected with 興 to *rise, raise*. (*cfr* Sans guru with similar meaning from root gur to *raise*). Hwang-fu is etymologically identical with Vrihaspati (*) the regent

(*) Vrih *to increase*, Vrish *to rule*, Ch. 皇 hwang. Pati. *lord*, Ch. 父 fu.

of the planet Jupiter. The eclipse of the sun and moon are naturally accompanied by other celestial prodigies. Jupiter in line 34 seems to be out of season 不時, but the singer in 40 pertinently suggests that his movements may after all be fixed by immutable laws. The earthquake and the fall of Mount. K'i are mentioned in the Kwoh-yu, and the occurrence is accepted by the narrator as an omen of the approaching downfall of the state. Although the story of Pao-sze would have been admirably suited to the didactic character of the Kwoh yu, and might have been expected to find a place in the Odes, it is not to be found in either, and the conclusion therefore at which we must arrive is that it is of later origin, and sprung from the same common stock of myth which gave Mêhi to Kit and Tanki to C'how. It is curious to find that in the case of the destruction of the state of Wû by Yueh, B.C. 472, an event well within the historical epoch, the fair Si-shê is introduced in the later works as playing a similar part to Pao-sze's in the ruin of the kingdom. There is indeed in all nations a period when myth is far stronger than history, and when really historical events in the course of a few generations receive an incrustation of legends, once freely floating about, but which like crystals separating from a mother liquor, seize on and accumulate round any foreign substance introduced into the solution.

The ode seems to refer to violent floods which succeeded the other prodigies mentioned in the first two verses; but in turn it seems to have become a matrix for the aggregation of the older myths, still floating about, but with the gradual change of the language becoming unintelligible. The 32rd line is a case in point. As written the Yen-t'sai means beautiful *wife* (Sans dârâ,) and Dr. Legge in his translation seeks to apply it to the usurpation by Pao-sze of the position of the queen. The ending of the line 'shiu fang ch'u, shines (from her) place, implies no such idea, but rather refers to a steady and long continued occupation. T'sai may however equally well be taken as the representative of Dhruv-a, (*) the Pole-Star of the period, apparently still *Alpha* Draconis, and will thus agree with the other celestial bodies mentioned in the verse. That T'sai is called beautiful and that she flashes agree with what we know of the history of the star, which in ancient times shone with a much more powerful light than now. Dhruva was moreover gradually losing its right to represent the Pole owing to its increasing distance, and hence its name the "Fixed" was becoming inapplicable and gradually dropt out of parlance.

(*) Dhruva appears as Ch'ū 杵 in the Shû-king V. III. 9.

In the ode Ching Yueh (II. 4. VIII.) the name of Pao-sze seems indeed to occur. The 64th line is as follows 褒姒威之, translated by Dr. Legge in accordance with the accepted rendering "Is being destroyed by Sze of Paou" (Pao-sze). The line reads, transliterated, "Pao-sze mit-chi" and the construction without an instrumentative of any sort seems awkward in the extreme. I should be disposed to read the line 'Pâras mridyate' where pâras is the equivalent of Greek Πέρας and to translate the context.

"The blazing faggot
  In the end burns itself out
Our bright and honoured Chow
  Is at last extinguished."

The accidental resemblance of sound seems to have afforded an opportunity to the transcribers to introduce the name of Pao-sze. That the myth was already in process of development we learn from the Shi-ki where the story of Pao-sze's supercession of the queen is mentioned, without, however, the surroundings of fable which subsequently accreted about it.

In line 27 I have represented the Chinese 家伯 ka-pak by its natural analogue in Sanscrit ka-pûja which survives to our day in the constellation Cepheus. 番維司 Fan-wei-sze in line 26 I have taken to stand for Parâçara. the Perseus of our modern sky. 仲允 Chung wan (chung in lower 3rd tone) regularly represents Sravanâ part of Capricornus, and 聚子 Tsau-tsze seems to be for Savitra, Spica Virginis, in modern Chinese 角 koh, the Horn. 蹶 kwei or kut probably stands for ketu one of the nine Indian planets, represented as drawn in a chariot with eight dusky steeds. Yu, the leader of the host, would then be Bharani, in modern Chinese 胃 Wei, the two chief stars in Musca and *delta* of Aries.

The astrological rendering I have given to the ode, while it throws some light on the myth of Pao-sze, is quite in consonance with the general character of the book. The ballad Ta-tung (II. 5. IX.) deplores in mournful strains the short-comings of Chow, and complains of the evil influence of the heavenly host. Verse 5 proceeds (I quote this time Dr. Legge's version).

There is the milky way in heaven,
  Which looks down on us in light;
And the three stars together are the Weaving Sisters,
  Passing in a day through seven stages of the sky.

Although they go through their seven stages,
  They complete no bright work for us.

Brilliant shine the Draught Oxen (*)
But they do not serve to draw our carts
On the east there is Lucifer
On the west there is Hesperus (†)
Long and curved is the Rabbit net (‡) of the sky
But they only occupy their places,
&c., &c.

I have above expressed my doubts as to the occurrence in the Classic of the phrase T'ien tsze as applied to the ruler of the Chows. Two words are used to express sovereignty; one, as we have seen, the more general term of 君子 kiun-tsze, in form agreeing with Sanscrit janitar, but in meaning identical with janaka, *pater, princeps;* the other 王 Wang apparently connected with Gr: Ἄναξ, Fάναξ. The word 子 whenever used as a suffix in the odes has invariably its substantival meaning of doer, Sanscrit tar or tri, Greek τηϛ, τωρ. Thus we have from 公 kung (Sans çûr-as; Greek κῦροϛ) 公子 an officer (not the son of an officer as absurdly rendered by Dr. Legge I. 15. I. 2); 童子 t'ûng-tsze a youth (Sans. dârak-as) not the son of a youth; 宗子 tsung-tsze relations (Sans. sach, to follow; sa*n*j to affix); 君子 kiun-tsze, a prince, not son of a prince; 士子 sze-tsze an officer (?Sans trâ-tri *serva-tor*); 舟子 chao-tsze a boatman, not son of a boat. In like manner we must assume the suffix in 天子 to be a substantival ending, and may compare it with Indra, as if inditar, the 'Ruler' *par excellence* from root ind, *regere*, Indra, Lord of the Heavens. Max Müller, however, derives Indra from a root meaning to *drop, distil* which has been lost in Sanscrit and the allied languages, but even in such a case the existence of the root ind to *rule* may have conduced to its later Chinese use as applied to the king or emperor. In the Shû-king (III. 4. IV. 5.) the phrase cannot be applied to the emperor. The emperor himself addresses thus his officers "Help me reverently to carry out the commands of T'ien tsze" 尙弼子欽承天子威命. So also (VIII. 1. I.) we are told "Tien tsze presides over the myriad states 天子惟君萬邦; the officers reverence and honour Him. The words of

(*) The 牽牛 Kien ngau are apparently the Çunâsîrau of the Indian astronomy, the Cynosura of the Greeks. By the Chinese the name has been applied to the Stars α, β, γ of Aquila. The position of the Indian stars seems doubtful. See M. Müller; Science of Language Vol. II. p. 525

(†) 長庚 Ch'ang kang, Sans. Çukra.

(‡) 畢 Pat the Hyades.

the king are His commands; if the king do not speak, the ministers under him have no means of carrying at His behests." In V. 4. I. we have a still stronger statement of the relative positions of the king and T'ientsze. "T'ientsze," we are told "is the parent of the people, and the king is his representative on earth" 天子民父母以爲天下王.

In the poetical Classic the distinction between T'ientsze and the sovereign is for the most part as well marked, and generally the two are placed in distinct correlation. The Ch'uh-ku (II. 1. VIII.) begins

Let us go in our chariots
 Against the shepherds:
It is T'ientsze himself
 Calls on us to come.
Call out the officers;
 Tell them to prepare;
The king's affairs are straightened
 And surrounded with difficulties.

* * *

The king prays Nam-chung
 To go settle the frontiers:
Let the chariots rattle along,
 The flags flutter gaily.
T'ientsze orders us
 To settle the disturbed region:
Bright is Nan-chung
 In harrying the Himwan.

&c.

In the Luh-yueh (II. 3. III. 2.) occur the lines 王于出征, 以佐天子.

The king went on the expedition
 As the lieutenant of Tientsze

The Kiu-loh III. 2. v. describes the virtues which the sovereign 君子 should posess

(Knowing when) to bind and when to relax.
 Generous in the royal banquets,
All the princes and officers
 Will be pleasing to Tientsze:
Not remiss in his duties,
 The people will be tranquil.

In one ode indeed we have the king called the Son of High

Heaven 昊天其子之, in the Shi-mai (IV. I. (1). VIII.), but the lines in which it occurs are evidently interpolated, or rather stand as an introduction. "Of the Son of High Heaven when he was extending the state;" and the king referred to was Wan Wang who subdued by mildness the spirits themselves. Indeed the line of Chow could scarcely with consistency claim descent from T'ien. The ode Shang-min (III. 2. I.) gives the traditional descent of Chow from Kiang-yuen, who as a virgin gave birth to Howtsik, *i.e.* Daksha. As the legend is almost identical with that preserved in the Purânas it is worth quoting. According to the Indian myth the nymph Pramlochâ was sent by Indra to beguile the sage Ka*n*du*;* discovering that he had been deceived he drove her away with impreations. As she fled through the forest the perspiration poured off her, and was collected by Soma, and became Marishâ the Nurseling of the trees.

Marishâ was childless and prayed to Vishnu, Vishnu gave her for husband the Prachetasas, as anxious as herself to become the progenitors of mankind: from the union sprang the patriarch Daksha. Except for the change in sex of Kandu, who becomes in the Chinese myth the nymph Kiang-yuen, omitting the intermediary Marishâ, the legends are identical; and How-tsik, the Daksha of the Chinese, becomes the progenitor of the house of Chow.

But under the influence of the pantheistic philosophy which in the latter days of the Chows came to supersede the earlier polytheism of the race, the personality of the old gods became sunk. We have seen their gradual supercession before the growth of T'ientsze, or Indra; but T'ientsze himself gradually changed on the one side into an abstractive How-t'ien 昊天 as we ourselves say 'High Heaven'; and on the other hand losing his divine character as one of the Shang-ti became a designation for the Wang. The change was not so violent or unnatural as might have been supposed owing to the really divine attributes of Wan and Wû-wangs, whom we find first mentioned as T'ientszes. It was of the same nature, but by no means so startling as the title assumed by Ching-wang of T'sin on assuming the empire of Hwang-ti, '*Deus imperans*'; with which we may compare the title of Θεός assumed by Antiochus II. of Syria, who strangely enough died in the very year of Ching's accession, B.C. 246.

In the Shu-king we have noticed T'ien-tsze called the parent of the people; the same idea occurs in the Shi with reference to T'ien or How-t'ien. The Kiao-yen II. 5. IV. says of High Heaven that it is "called our parent" 曰父母且 while the Ching min III. 6. I. says that Heaven "produced the multitudes of the

people" 天生烝民. Still even in the time of Confucius the change from the personality of T'ïen-tsze to the abstract idea of the modern T'ien does not seem to have been complete. He could speak, (Analects XVI. II.), of the Wang as T'ien-tsze, while in the DOCTRINE of the MEAN he speaks of Shun as having virtue like that of a sage, and glory as of T'ien-tsze. 德爲聖人尊爲天子. In the time of Mencius the change was complete and the T'ien-tsze was now identical with the Wang. As there could not be two suns in heaven, so neither could there be two Wangs on earth; so, he says, that Shun did not become T'ien-tsze till after the death of Yaou, else there would have been two T'ien-tszes in the land, a thing manifestly impossible (V. 1. IV. I.). It is worthy of note as giving some indication of the approximate period of the change that the first mention of the king of Chow as T'ien-tsze occurs in the C'hun t'siu under the date of the eighth year of Duke C'hing B.C. 582, the previous title given to the sovereigns being 天王 'king by the grace of Heaven;' and it curiously happened that this date concided with the period of Chow's greatest degradation, when it was dependent for its very existence on the good offices, often presumed on, of the state of Tsin.

With the progress of the new philosophy the remembrance of the more distinctly personal gods of the old cosmogony gradually died out, and when the forgetfulness was complete a new derivation was found for the term T'ien-tsze. It mattered little that the translation of 'Heaven's Son' was contrary to the whole genius of the language; we see in all ages such frauds foisted on humanity when a purpose is to be subserved. High Heaven, said the Book of Poetry, had given birth to the multitudes of the people; and this expression constituted a stepping stone, when old legends had grown out of mind or were misunderstood, to the idea that T'ien-tsze meant the Son of Heaven. There seems no authority for the time that this absurdity was perpetrated, but it certainly was current in the times of the Han emperors. The T'sien-Han-Shu tells us of how the Turkish Shen-yu adopted the title of Changli Kwatu *i.e.* Tangri-uchal, in the Wigour dialect meaning 'Son of Heaven,' a manifest imitation of the style of the Chinese emperors under the false but flattering etymology found for it by the philosophers of the day.

With this title, though of later date, we may compare the term Fagfur used by mediæval writers for the emperor. Mr. von Mollendorff informs me that the term is the Persian name fagh-fur *i.e.* Son of Heaven, in Sanscrit Bhagaputra (Pers. fag or bagh, God; fur or pur, son.

On the whole we seem justified in assuming that the Poetic Classic of the Chinese was the production of an age of transition from old polytheism to more modern pantheism. Even in the odes themselves the change is apparent, though probably unperceived by the authors, themselves. Between the period when the last of the odes was composed, about 780 B.C., and the time when they were reduced to writing nearly seven centuries elapsed. This period was marked by many and violent changes; the empire of Chow became reduced to a nullity; in turns one or other of the formerly dependent states aimed at imperial sway; till after exhausting wars lasting for nearly three centuries the iron despotism of T'sin at last prevailed, and under the strong rule of Shi Hwangti the empire was finally welded into one, never again to be permanently divided.

T'sin was of different race from the other states. Its princes seemed to have belonged to that wide spread branch of the original Aryan race known as Scyths or Sakæ; (*) and to which, European ethnologists notwithstanding, I am disposed to confine the term Turanian; and acting on the instincts of a different race sought to destroy all traces of the former cult. The means taken were ineffectual; writing had been of so recent introduction that many of the productions of the past still lingered in popular recollection. Amongst these were the Odes. Wars, conquests, and alliances had in the meanwhile fused together the varying elements of which Chinese had been composed; and the language of the Classic was no longer the language of China. On the one hand the transcribers honestly attempted to preserve in the written record the traditional sounds and inflections of the original, and on the other the written language had already become linked with a monosyllabic dialect not differing in its main features of tone and termination from the present dialect of Canton. The result was a compromise, the key of which soon became lost for the Chinese themselves, but which as I have attempted to point out, is really to be found in the ancient language of northern India, originally sprung, like Chinese itself, from the speech of the Aryans of High Asia before circumstances had impelled them to wander south, west and east from their ancestral seat.

The legends which tell of the flight of the Chows from Central Asia, of their crossing the Liang-shan or Dard Mountains; of their settlement at the foot of Mount K'i (Indragiri, the T'ien-shan of to-day); of their wars with the Maddhs, the Ephthalitæ of later days; of their abandonment of Mount K'i before the persistent

(*) Ethnological Sketches from the Dawn of History;—The T'sins or Seres; by the author. *China Review*, Vol. V., 349, &c.

attack of the Turks and their precipitation on China, are related with more or less distinctness in the epics of the Ta-ya; and those legends are fortunately supplemented by traditions preserved in the Tso-chuen, the Kwoh-yu, the Shû-king, the Analects of Confucius, and the works of Mencius. Fortunately the dynastic histories took up these legends before they had died out of popular memory; and though the result is a strange medley which it is preposterous to call history, our thanks are due to those worthy men, who ignorant as they were of the true value of the ancient myths, were yet sufficiently patriotic to collect and hand them down for later generations.

It is no discredit to Szma T'sien, to Kung An-kwoh or Chu Hi, ignorant as they were of every thing outside the Flowery Land, that these legends should have resulted in the so called histories of the earlier dynasties in China: but it reflects no honour on the modern school of Sinalogues that with the works of Nieburh and Mommsen before them they have been unable to advance a single step towards a critical analyses of the numberless legends with which the earlier works of the Chinese authors literally bristle.

Beyond the graver works of the historians, the philosophers and the bards of China there exists in the various works relating to Taoism a vast repertory of myth and legend of very varying authenticity; and while it is undoubted that the greater portion of these legends are composed of the most utter thrash, and that another portion consists of stories directly introduced from Indian sources, there still remains a modicum of ancient myth well worthy of critical investigation. The folk lore of China is not less interesting nor less important for ethnological purposes than the folk-lore of Europe, so ably illustrated by the brothers Grimm, and fortunately much of it exists in a tangible form. We smile at the stories of the K'wen-lûn, of the fairy realms of Si-wang-mu and the Joh-shui, yet therein we have a Chinese version of the Indian stories of the Gândhârvas, of Mount Meru and the drying up of the Central Asian sea. This is only one amidst hundreds of others illustrating celestial and terestrial phenomena, as well as throwing light on the primitive ethnology of Central Asia. (*)

TABLE OF MUTATIONS BETWEEN ANCIENT AND MODERN CHINESE.

1.—Unaspirated letters in modern Chinese represent the corresponding letters in the ancient tongue.

2.—Aspirated letters in the modern represent the corresponding sonants and aspirates in the ancient speech.

(*) The Chine e text of the portions of the Odes translated will be found in Appedix.

This second rule has, however, to be modified on account of the tyranny exercised in Chinese by the *tones* over the other essentials of language; we have therefore.

3.—The third and fourth lower tones being unable to take the aspirate, words in these tones which according to rule 2 should begin with an aspirate have to exchange the aspirate for the corresponding non-aspirate.

4.—Modern palatals (*ch* and *ts* and sometimes *sh* and *s* are the representations of older dentals, and in the aspirated series (ch' and ts') are frequently substituted for original sibilants.

5.—*Ng* final is the usual representative of *r; n*, however, occasionally taking its place. Sometimes *r* follows the rule for *l* which may be stated thus.

6.—*L* final disappears in modern Chinese, and its loss is represented by a lengthened vowel or more frequently a diphthong, the most usual being *ao.*

7.—*L* initial represents generally an older *l* or *r*, not unfrequently however it is substituted for an original *d* or *dh.*

8.—*Y* initial most frequently represents *w* or *v;* like the Greek digamma it occasionally is the last existing trace of other consonants especially, *j* or *n* with which in the various dialects it is more or less interchangeable.

9.—In accordance with rule 4, we find that the series *ch'*, *ts'*, *sh*, *s*, and *t'* are frequently substituted one for the other; *ç* sometimes is treated as a sibilant, but frequently, and especially when terminating a root becomes *k.*

10.—Double consonants in the old language drop one or other of their constituents, and frequently are found represented in two or more forms as one or the other is rejected.

These are the principal rules applying specially to Chinese: other substitutions common in all languages are occasionally to be noticed, but do not here need special remark.

A few illustrations will exhibit the changes which have occurred.

By rule 1 kar 工 *work, labour,* becomes kung; tal *to found, fundamental* 氐 ti, or tai; pûj *to honour* becomes 伯 pâk a *superior* or 僕 pûk a vassal.

By rule 2 gir(i) *a mountain* becomes 岐 k'i; dul *to raise, to carry,* 桃 t'iao; bal *to rend, to explore,* 破 p'i. But as modified by 3 dal *to divide,* 度[2] tû *a division, a degree;* bind *to part, separate* 辨[2] pien.

By rule 4 drum(a) *a tree* becomes 杉 ch'am, *the fir;* sich to moisten 澤[2] tsak or chak; târ or stârâ *a star* 星 sing, &c.

Rule 5 exemplifies changes such as the last kûr *a lord, a hero* into 公 kûng; (k)shar *water* to 池 ch'i or 塘 t'ang; sur *to shine* to 昌 ch'ang, &c.

Rule 7 may be noticed in the change from dharm(a) a law to 倫 lûn; dar *a cave* to 籠 lûng or 峒 tûng.

By rule 10 we have from aksh *a wheel, a chariot* 車 kiu or ch'e; stri *to strew, extend* 陳 chan or ch'an; çlish *to join, tie,* 結 *kit a knot* 纈 kit or lit *id.*, &c.

The transliterations of the various ballads given in the foregoing pages will exhibit many more applications of the rules.

APPENDIX.

Chinese Text of Selections from the Classic of Poetry in Mr. Kingsmill's Paper.

I. 1. i. The Kwan T'seu—page 98.

關雎

關關雎鳩在河之洲窈窕淑女君子好逑

參差荇菜左右流之窈窕淑女寤寐求之求之不得寤寐思服悠哉悠哉輾轉反側

參差荇菜左右采之窈窕淑女琴瑟友之參差荇菜左右芼之窈窕淑女鍾鼓樂之

I. 12. x. The Tsih-p'o—page 106.

澤陂

彼澤之陂有蒲與荷有美一人傷如之何寤寐無為涕泗滂沱

彼澤之陂有蒲與蕑有美一人碩大且卷寤寐無為中心悁悁

彼澤之陂有蒲菡萏有美一人碩大且儼寤寐無為輾轉伏枕

II. 3. iv. The Ts'ai k'e—page 109.

采芑

薄言采芑于彼新田于此菑畝方叔涖止其車三千師干之試方叔率止乘其四騏四騏翼翼路車有奭簟茀魚服鉤膺鞗革

薄言采芑于彼新田于此中鄉方叔涖止其車三千旂旐央央方叔率止約軝錯衡八鸞瑲瑲服其命服朱芾斯皇有瑲葱珩

鴥彼飛隼其飛戾天亦集爰止方叔涖止其車三千師干之試方叔率止鉦人伐鼓陳師鞠旅顯允方叔伐鼓淵淵振旅闐闐

蠢爾蠻荊大邦為讎方叔元老克壯其猶方叔率止執訊獲醜戎車嘽嘽嘽嘽焞焞如霆如雷顯允方叔征伐玁狁蠻荊來威

II. 4. vii. The Tsieh Nan-shan—page 112.

節南山

節彼南山
維石巖巖
赫赫師尹
民具爾瞻
憂心如惔
不敢戲談
國既卒斬
何用不監

節彼南山
有實其猗
赫赫師尹
不平謂何
天方薦瘥
喪亂弘多
民言無嘉
憯莫懲嗟

尹氏大師
維周之氐
秉國之均
四方是維
天子是毗
俾民不迷
不弔昊天
不宜空我師

II. 4 ix. Shap yut chi kiao—page 115.

十月之交
朔日辛卯
日有食之
亦孔之醜
彼月而微
此日而微
今此下民
亦孔之哀

日月告凶
不用其行
四國無政
不用其良
彼月而食
則維其常
此日而食
于何不臧

爗爗震電
不寧不令
百川沸騰
山冢崒崩
高岸為谷
深谷為陵
哀今之人
胡憯莫懲

皇父卿士
番維司徒
家伯維宰
仲允膳夫
聚子內史
蹶維趣馬
楀維師氏
豔妻煽方處

抑此皇父
豈曰不時
胡為我作
不即我謀
徹我牆屋
田卒汙萊
曰予不戕
禮則然矣

II. 4 viii. Ching Yut—page 118.

燎之方揚
寧或滅之
赫赫宗周
褒姒威之

II. 5 ix. Ta tung—page 118.

維天有漢
監亦有光
跂彼織女
終日七襄

雖則七襄
不成報章
睆彼牽牛
不以服箱
東有啓明
西有長庚
有捄天畢
載施之行

II. 1 viii. Ch'ut kü—page 120.

我出我車
于彼牧矣
自天子所
謂我來矣
召彼僕夫
謂之載矣
王事多難
維其棘矣

王命南仲
往城于方
出車彭彭
旂旐央央
天子命我
城彼朔方
赫赫南仲
玁狁于襄

III. 2 v. Kia loh—page 120.

之綱之紀
燕及朋友
百辟卿士
媚于天子
不解于位
民之攸塈

ARTICLE VI.

THE CLIMATE OF EASTERN ASIA

By Dr. H. Fritsche,

Director of the I. Russian Observatory at Peking.

PREFATORY REMARKS.

In this work I have attempted to compile all the meteorological observations which have been made in Eastern Asia up till the present time, and to establish by their help the laws of meteorological phenomena ruling in Eastern Asia within the parallels 10° and 60° and the meridians East from Greenwich 100° and 160°.

The greater part (little more than a half) of these observations has been made by Russians, about one-third by Englishmen and Americans, and the rest by Frenchmen, Belgians and Germans. The observations, made by the Customs staff at the Treaty Ports in China have unfortunately not been of very great use, being very incomplete, and obtained with instruments whose corrections are not known.

It is to be regretted, that the laudable intention of the Inspector-General of Customs, dating as far back as 1869 (ref. Documents, relating to 1st. The establishment of meteorological stations in China; and 2nd. Proposals for co-operation in the publication of meteorological observations and exchange of weather news by telegraph along the Pacific coast of Asia) has hitherto been without success, because with the means at command, it would not be difficult to obtain very important results at a small expense, if only proper means were adopted.

I shall be very glad, if in these pages I have contributed somewhat towards explaining the laws of meteorological phenomena in Eastern Asia, and towards urging on new observations, with the object of obtaining the final aim of the science, viz., the prediction of the weather.

I am much obliged to the well-known author, Dr. Dudgeon of Peking, to C. Arendt, Esq., secretary of the German Legation at Peking, and T. W. Kingsmill Esq. for their kindness in correcting the translation of my work from German into English, made by myself.

H. Fritsche.

Peking, December, 1877.

TABLE OF CONTENTS.

VI.—13 Charts shewing by isothermal lines the distribution of the mean monthly and annual temperature in Eastern Asia, and 5 Charts shewing by arrows the prevailing winds in Eastern Asia.

I.—INTRODUCTION.

a. Preliminary Remarks.

During a period of about nine years, spent partly in travelling in Eastern Asia and partly dwelling at Peking, I have procured, besides hypsometrical, geographical and magnetical observations for a great number of different places, the materials for determining the elements of the climate of Eastern Asia.

My hypsometrical and astronomo-geographical determinations in Mongolia, Manchuria, Amoor-Territory and China (being a necessary basis for the knowledge of the climate of these countries), and my researches on the terrestrial magnetism for 147 different places in Middle and Eastern Asia, I have published in 21 memoirs, printed for the most part in German by order of the Academy of Sciences at St. Petersburg, and partly in Russian by the Imperial Geographical Society at St. Petersburg. The number of my treatises, containing meteorological researches, is up to the present time only four: two concerning the climate of Peking, one embodying the results of observations, made during a sea-voyage from Peking via Shanghai and Eastern India to Europe, and one describing the climate of the Amoor Territory.

In composing the present work, I have used, besides these 25 memoirs, published by myself, a number of other publications, for instance, the celebrated book of the Academician Wesselowsky "On the climate of Russia," the learned treatises of the Academician Leopold v. Schronck "on the currents in the Seas of Okhotsk and Japan," and especially the valuable contributions of Dr. J. Hann in his well known Journal. "Zeitschrift der oesterrechischen Gesellschaft fur Meteorologie."

The details of the works on the subject, which I have consulted and used, and regarding the meteorological observations procured by myself, are given at those places of the present work, where I have applied them, especially in mentioning the monthly mean temperatures, which have been determined, without exception, at all the 43 places of eastern Asia, for which we possess meteorological observations.

b. Geographical sketch of Eastern Asia and the adjacent countries.

For a better understanding of the climatological researches of Eastern Asia, I will first in the way of introduction make some short remarks on the nature of the country composing the basis of the ocean of air, the object of our disquisition.

Taking into consideration the colossal extent of this continent, we find in the interior of Asia—in contrast to North America—only a small number of lakes, and these of no great dimensions.

Great plains of low elevation over the level of the sea, are to be found only in the western and north-western parts of Asia.

The greatest mass of Asia is composed of highlands and chains of mountains.

We find here the highland of Tibet (about 3—4000 metres above the level of the sea), surrounded by the highest mountains of the earth, the Kwen-lun and the Himâlaya (the Kwen-lun having a mean elevation of about 6000 metres, the Himâlaya of 5000 metres); further the highland of Mongolia (1000-2000 metres above the sea-level), surrounded by the Kwen-lun, the Thian-shan, (mean elevation about 3000 metres), the Altai and Sayan mountains (mean elevation about 1500 metres), the Yablonnoi Chrebet (mean elevation about 1000 metres) and eastern Khingan (mean elevation about 1000 metres, longitude about 120° East from Greenwich).

This great and elevated mass of land is surrounded on the south-west by the highland of Persia, (1200 metres above the sea-level); in the south by the low plains of the Ganges and Indus and the Deccan plateau (1000 metres above the sea) and the mountains of India beyond the Ganges; in the north-east by the low mountain chains (1000 metres) and little elevated plains of Eastern Siberia; and at last in the east and south-east by Manchuria and China. For the Himâlaya, Kwen-lun, Thian-shan, Altai, Sayan mountains and Yablonnôi Chrebet, the directions of the chains is chiefly West and East; the direction of the mountain chains of India beyond the Ganges North and South; and that of the Chinese system SW. and NE.

China consists of two different parts, separated nearly at the latitude of 33° by the most eastern extremities of the Kwen-lun.

The mountain land of South-China as far as the ocean is, as the illustrious savant Baron Richthofen has observed, composed principally of plains, elevated above the sea from about 600 to 1300 metres; and the ridges have mostly the directions SW. and NE.

The mountains of North China, north of the Kwen-lun, have not so great horizontal extension as these of South China. Northern China consists of very low and wide plains, between the latitudes of 30° and 40° and longitudes of 113° and 119°, surrounding the Yellow River.

The eastern frontier is the ocean and the mountain ranges of the peninsula of Shan-tung. The western and northern frontier of North China is occupied by mountain ranges, which have the direction of S. W. and N. E.

The highest peak in them may probably not exceed 3000 metres above the sea.

The low plain of north China is confined in the north by the so-called Petscha, an agglomeration of mountains, which sends off to N.N.E. the Khingan, the eastern frontier of the table land of the Gobi; and to E. and S.E. another range of mountains, which extends through S.E. Mongolia.

To the east from the Khingan extend the plains of the rivers Liao-ho, Nonni-,Girin-and Sungari-ula; and more towards the east we encounter the mountains of Corea, Manchuria and the Ussuri Territory.

The height over the sea of the table land of Gobi is about 1000 metres; the height of the plains, east from the Khingan, which limits the Gobi, is only some hundred metres; and that of the peaks of the Khingan and of the mountains in Corea, Manchuria and the Ussuri Territory probably does not exceed 2000 metres. The summits of the islands of Eastern Asia and that of Kamschatka (4000 m.), Fusi-yama, near Yedo (4400 m.) In Formosa there exist also mountains of 4000 metres in height above the ocean.

The coasts are ragged and bluff, just as is also the coast of the Ussuri Territory, of Corea and South China. On an average the height of these islands over the sea-level is not great, but some volcanic peaks exceed 4000 metres, for instance the volcano of Kliutshews, in Kamschatka (4800 m.), Fusi-yama, near Yedo (4400 m.) In Formosa there exist also mountains of 4000 metres in height above the ocean.

c. The currents of the Pacific Ocean, bordering on Eastern Asia.

I will shew further on, in the following chapters, that the horizontal currents of the air consist chiefly in an interchange between the air reposing upon the neighbouring parts of the Pacific Ocean, and the air of the continent.

In consequence, the Atlantic and Indian Oceans, as well as the

Arctic Ocean have only a feeble and secondary influence on the climate of Eastern Asia: and we must occupy ourselves specially with the currents of the Pacific Ocean, and with the distribution of the temperature over its surface, if we wish to investigate the influence of the quality of the water on its climate.

In the neighbourhood of Eastern Asia there exist four different seas, namely the seas of Okhotsk, of Japan, the Yellow Sea with the gulf of Pechili, and the China sea extending as far as the straits of Malacca.

The western frontier of these four seas is the continent of Eastern Asia; the eastern frontier is indicated by Kamschatka, the Kurile islands, Saghalin, Japan, Formosa and the Philippines.

Upon the annexed charts I have marked the currents in the above mentioned seas and adjacent parts of the Pacific Ocean. I have further noted in these charts the highest and lowest temperature (Celsius) of the surface of the water observed in different months, and put down the temperature exactly in that part of the surface, to which it belongs.

The warm currents are represented by continuous lines, and the cold currents by broken lines.

The greatest of all the currents in the Pacific Ocean is the so called equatorial stream, produced by the difference in temperature between the pole and equator, and by the daily rotation of the earth around its axis from W. to E. In the northern part of the Pacific Ocean this current is included between the parallels of 20° and 10°; its depth is considerable. In the ocean it runs almost exactly from east to west as far as the southern end of Formosa and northern end of the Philippine islands.

There, near the tropic of Cancer, partly in consequence of its rebounding against these islands; partly because along the Coast of China from north to south there runs a cold current, the equatorial stream changes its direction, and one part turns to the north, and near the latitude of 30°, becomes divided into three parts.

One part is named the Kuro simo from the blackish blue colour of its warm water; it turns, near the latitude 30°, to E.N.E., passes the southern coast of the islands of Japan (Kiu-siu, Sikok and Nipon) and sends a small current to the N.E., to the sea of Behring.

But the greatest mass of its waters flows, partly in consequence of the earth's daily rotation, partly in consequence of the configuration of northern Asia and North America, and the shallowness of Behring's sea, towards the east; and, near the coast of North America to the S.E. and at last, concluding its circular motion,

joins itself again with the equatorial stream, from which it had started.

The second part of the equatorial stream, near the latitude of 30°, turns N.E., enters by the straits of Corea into the sea of Japan, washes the western side of Nipon and Yesso and disappears near the western coast of southern Saghalin. This current is named by Leopold von Schrenck the Tsusima stream, from the island of Tsusima, in the straits of Corea. During its course, as described above, the Tsusima stream attempts to enter into the Sangar strait, where it meets with a cold current, coming from the Kuriles; and sends a branch by the strait of Lapérouse into the sea of Okhotsk and to the eastern coast of Saghalin as far as the Cape of Patience.

The third branch of the equatorial stream goes to the north near the western coast of Corea, and returns to the south along the coast of China as a cold current, having lost its high temperature in the gulf of Petschili and in the northern parts of the Yellow Sea.

Besides these branches of the northern equatorial stream, which bring warmth to the countries where it flows, there exist in the seas of Eastern Asia some cold currents, taking a reverse course as compared with the warm streams, *i.e.* from N. to S.

The three cold streams of the sea of Okhotsk begin in its north-eastern part.

One runs to the south along the western coast of Kamtchatka, joins, near the southern extremity of this peninsula, another cold srream, which comes from the ice-ocean, having washed previously the eastern coast of Kamtchatka, goes further S.W., and surrounds the Kurile islands, the N.E., E. and S. coast of Yesso, and partly the coast of Nipon as far as the cape of Daiho-saki. This stream is named the Kurilian current.

The second cold stream, which has its origin in the north-eastern part of the sea of Okhotsk, extends along the eastern coast of northern Saghalin as far as the Cape of Patience. This is the Saghalin current.

The third cold stream of the sea of Okhotsk originates in its western part, runs through the Liman of the Amoor to the S. and S.W. and gives a contribution to the cold current of the coast of the Ussuri-Territory aud Corea, which commences near the Amoor-Liman (latitude 53°) and ends near the Corea strait, being named the Liman-current.

For the connection between the temperature of the water at the surface of the above described currents and the longitude and latitude (the geographical position), we have the following numbers :—

Kuro-siwo.

	Temperature of the water (Celsius.)					
	Longitude.	Latitude.	Annual Maximum end of the summer	Annual Minimum end of the winter.	Annual Amplitude.	Annual Mean.
Near its origin (island of Formosa)	123°	26°	31°	21°	10°	26°
Near the coast of Japan	138	33	30	19	11	24
Ocean	155	45	13	...	...	...

Tsusima Current.

	Temperature of the water (Celsius.)					
	Longitude.	Latitude	Annual Maximum end of the summer.	Annual Minimum end of the winter.	Annual Amplitude.	Annual Mean.
Before entering the strait of Corea	128°	32°	28°	16°	12°	22°
West from Hakodate............	140	41	24	10	14	17
Near La pérouse strait	142	46	17	*2	*15	*10
Western coast of Saghalin	141,3	47	16	*0	*16	*8

The temperatures *2 and *0, and in consequence also *15, *16, and *10 and *8 are hypothetic, not observed.

As regards the third branch of the warm equatorial stream, near the western coast of Corea, we have no observations of its temperature; for the cold stream along the coast of North China our charts give the annual maximum of 26° Celsius in September, and the annual minimum of 15° C. in February, near the latitude 27°.

As regards the temperature of the other cold streams, viz. the Kurilian, Saghalinian and Limanian—we know from observations

only the annual maximum, which occurs on the end of the summer; because during the cold season navigation is impossible within its limits.

The sea of Okhotsk is free from ice only during three months in the whole year, and sometimes ice is found floating near the Shantar islands in the month of August.

The Kurilian stream, toward the end of the summer, near the western coast of Kamtchatka, is six degrees warmer than around the Kurile islands—6° and 12 Celsius—in consequence of the land mass of Kamtchatka, which in summer grows hot and warms the water in its neighbourhood; and on account of the cold stream, coming from Behrings sea and joining the current of the Kurile islands near the southern Cape of Kamtchatka.

The annual maximum of the temperature of the Saghalinian stream is only about 9° C.; but the water of the sea of Okhotsk, near the town of Okhotsk, probably on account of the neighbourhood of the warm continent, attains in August the temperature of 14° C.

The Limanian stream presents in its different parts no great differences in its temperature: in August, near the bay of de Castries (latitude 52°), the temperature of the water is 15° C., and near Vladivostok (latitude 43°) 18° C.

In winter the temperature of all these cold streams will be approximately 0° C., except in a few places, where—as for instance the Kurile stream near the Cape of Daiho-saki (latitude of 36°)—certain branches of them, far from their origin, arrive in southern countries and come in contact with warm currents.

With reference to the tides in Eastern Asia, I will make the following short remarks:—

The difference between the high and low water is in the Amoor Liman, near the mouth of the Amoor river, about 3 metres; in the northern part of the Japan sea, about 2 metres; in the middle and southern parts of the Japan sea, about 1 metre. The floods decrease in the sea of Japan in the direction from N. to S.

Near the harbours of the Yellow Sea and the Gulf of Petchili the high tides vary between two and four metres; excepting only on the coast of western Corea, where the spring tides rise to eleven metres.

From the mouth of the Yangtse-kiang to Amoy the spring tides along the coast rise to 5 metres on the average; and between Amoy and Macao, and near the islands, N. E. of Formosa, as well as on the coast of Formosa and in the Bashee and Balintang channels the spring tides rise to 2 metres.

d. Longitudes and Latitudes and a Short Description of the Environs of the Stations of Observation.

Continent of Eastern Asia.

	Longitude from Greenwich.	Latitude	Height above the sea-level in metres	Position and Description of the Environs of the Stations of Observation.
1. Yakutsk	129° 45′	62° 2′	87	In the valley of the Lena River, at the point, where its course, diverted from W. to E., turns to the N. and N. W.
2. Okhotsk	113 17	59 21	4	Directly on the coast; on a plain.
3. Ayan...............	138 17	56 28	......	On the coast.
4. Udskoi	134 59	54 30	......	In the valley of the little river Udj, about 80 kilometres west from the sea of Okhotsk.
5. Nikolajevsk	140 43	53 8	14	Near the mouth of the Amoor river, on the left bank; to the N., plain land, mountains distant and low; on the right bank, mountains, not exceeding the height of 300 metres.
6. Mariinsk	140 11	51 42	......	Plain; height over the sea-level probably very little, not more than 50 metres.
7. Urga	106 51	47 55	1150	In the valley of the river Toola, having the direction W. and E.; width of the valley in the direction N.S. about 4 kilometres; the mountains towards S., the Han-ola, reach the height of 1650 metres over the sea-level.

d. LONGITUDES AND LATITUDES AND A SHORT DESCRIPTION OF THE ENVIRONS OF THE STATIONS OF OBSERVATION.

Continent of Eastern Asia.

	Longitude from Greenwich.	Latitude.	Height above the sea-level in metres.	Position and Description of the Environs of the Stations of Observation.
8. Nerchinsk.........	119° 37′	51° 18′	592	Between mountains, about 125 metres higher than the station of observation.
9. Blagoveshschensk	127 37	50 15	110	Plain; towards N., a mountain chain on the embouchure of the Dseya where it enters the Amoor.
10. Imperial Harbour	140 19	49 1	......	Plain; in the distance low mountains; height over the sea-level inconsiderable.
11. St. Olga Bay......	135 19	43 46	......	Observations made in the roads, surrounded by high mountains.
12. Vladivostok	132 0	43 9	......	Plain; height over the sea-level little.
13. Possjet	130 54	42 40	......	The environs hilly; height over the sea-level little.
14. Si-wan-tse.........	115 18	40 59	1195	Narrow valley between low hills, running N. E. and S. W.
15. Kalgan	114 55	40 51	826	A deep dale between mountains, 1200 metres over the sea-level.
16. Newchwang	122 13	40 41	......	Plain; about 30 kilometres from the embouchure of the Liao-ho in the gulf of Liao-tung; height over the sea very little.

I. Longitudes and Latitudes and a Short Description of the Environs of the Stations of Observation.

Continent of Eastern Asia.

	Longitude from Greenwich.	Latitude.	Height above the sea-level in metres.	Position and Description of the Environs of the Stations of Observation
17. Peking	116° 29′	39° 51′	37,5	Plain; to the W., N. W., N. and N. E., about 40 kilometers from Peking begin the mountains, not exceeding 2500 metres elevation over the sea-level; to the S., S. W., S. E. and E. a wide plain.
18. Tientsin	117 11	39 7	2	Plain; on the right bank of Peiho river, 40 kilometers W. N. W. from its embouchure in the gulf of Petchili.
19. Taku	117 40	38 59	5,6	Plain, on the right bank of the Peiho, only some kilometres from its embouchure in the gulf of Petchili.
20. Chefoo	121 25	37 33	......	On the coast, height over the sea-level little; to the S. a ridge of mountains, the peak of which is elevated 400 metres above the sea.
21. Shanghai	121 20	31 12	7	Plain; near the Woosung river, about 40 kilometres from the ocean.
22. Fu-cheu-foo	119 22	26 3	......	Near the mouth of the river Min; in a plain; in the N., at some distance, surrounded by a mountain chain, whose height over the sea does not exceed 600 metres.

d. Longitudes and Latitudes and a Short Description of the Environs of the Stations of Observation.

Continent of Eastern Asia.

	Longitude from Greenwich.	Latitude.	Height above the sea-level in metres.	Position and Description of the Environs of the Stations of Observation.
23. Canton …………	113° 17′	23° 8′	12	About 100 kilometers N. from the Ocean, near the mouth of the Pearl River; to the W. and N., a wide plain; to the N. E. and S. E. mountains, whose height over the sea does not exceed 1300 metres.
24. Saigon …………	106 42	10 47	……	Near the embouchure of the Saigon river in the China sea; plain; height over the sea-level little.
25. Bangkok ………	100 25	13 43	……	Near the mouth of the Menam river; plain; height over the sea not great.

Islands of Eastern Asia.

26. Petropaulovsk …	158 48	53 0	15	Harbour.
27. Dui ……………	142 26	50 50	……	In a deep dale, on the western coast of Saghalin; height over the sea about 100 metres.

d. Longitudes and Latitudes and a Short Description of the Environs of the Stations of Observation.

Islands of Eastern Asia.

	Longitude from Greenwich.	Latitude.	Height above the sea-level in metres.	Position and Description of the Environs of the Stations of Observation.
28. Kussunai	142° 20′	48° 0′	......	Coast; plain, low; only on the E. side some hills.
29. Aniwa Bay	112 52	46 39	......	Coast; on a low plateau.
30. Hakodate	140 45	41 46	9	On the northern declivity of a mountain of 348 metres height; to N. and N. E. high mountains; between these mountains and the station of observation is situated the road of Hakodate.
31. Niigata	139 10	37 55	......	On the western coast of Nipon.
32. Yedo...............	139 47	35 41	5	On the western shore of the gulf of Yedo.
33. Kanagawa.........	139 40	35 30	......	On the western shore of the gulf of Yedo.
34. Yokohama	139 40	35 27	3	On the western shore of the gulf of Yedo; plain; being the E. N. E. extremities of a valley, running W. S. W. and E. N. E.; height over the sea very little.
35. Osaka	135 10	34 20	......	
36. Nagasaki	129 42	32 44	......	Town on the declivities of mountains, surrounding the roads of Nagasaki.

d. Longitudes and Latitudes and a Short Description of the Environs of the Stations of Observation.

Islands of Eastern Asia.

	Longitude from Greenwich.	Latitude.	Height above the sea-level in metres.	Position and Description of the Environs of the Stations of Observation.
37. Decima	129° 42′	32° 44′	8	A small island within the road of Nagasaki which trends deep into the land, and is surrounded by mountains 600 metres in height.
38. Nafa	128 44	26 13	10	
39. Kelung	121 46	25 20	15	Harbour on the northern base of a mountain, elevated over the sea about 70 metres; the road is open only to N. and N.E., where is the ocean; the other sides of the harbour are surrounded by mountains.
40. Victoria	144 9	22 16,5	17	On the northern declivity of the island of Hongkong, near a road, surrounded by mountains, whose height does not exceed 600 metres above the sea.
41. Victoria Peak	144 9	22 16	532	The peak of the mountain ridge, on whose declivity the English town of Victoria is built.
42. Macao	113 34	22 11		On a peninsula, surrounded by the ocean, near the mouth of the Pearl river; no mountains; height over the sea little.
43. Manila	121 0	14 36	33	

II.—THE TEMPERATURE OF THE AIR.

a.—Daily Period.

All the temperatures, mentioned in this work, are, if no other notice is given, expressed in centigrade scale (Celsius); and all the lengths, especially the terrestrial distances, the heights of mountains and of the barometer, the amount of rain, the force of aqueous vapour of air according to the metrical system.

It is to be regretted, that the governments on the European continent and the representatives of science, as for instance meteorologists, when changing the units of measure during the last half of the present century, have adopted the French system instead of the English, as has been advised by some eminent scholars (Lamont at München, Dove at Berlin.)

One of the consequences of this mistake is, that in meteorology at present two different systems prevail: the *French*, adopted by the greatest part of Europe and Asiatic Russia with about 800 meteorological stations, and *English*, adopted by Great Britain and her colonies in Australia, India, Africa and North America and by the United States, also with about 800 meteorological stations.

If the continental states of Europe, when finding it necessary to change their system of measures in order to obtain uniformity, had adopted the English system, this desideratum would at present have been obtained, for in this case, there would be only France, with its small territory still adhering to its own system. With respect to the real value of the English system consisting in the facility and exactitude of re-establishing it, in case the standard-etalon should be lost, I would say, that the French system differs more from the so-called natural measure than the English, for the metre is not exactly the 10 millionth part of the quadrant of the earth, whose shape is irregular and can never be determined with the utmost exactitude; and that on the other side the English standard-yard is compared very exactly with the length of the pendulum at London, whose value can be more easily determined with exactitude at any time, than the length of the earthquadrant.

Further, the English standard-etalons have been compared with those of the European continent with greater exactitude and more frequently, and are older than those of all other countries.

The oldest standard-etalon (yard), preserved at present in England, was established in 1588; only the original Troy pound at the Hague is more ancient, dating from 1554. Besides this it must not be forgotten, that the English race now occupies the greatest and richest part of the globe and dominates to a certain degree the whole trade of the world.

OKHOTSK. HOURLY RANGE OF THE TEMPERATURE.

From the Sapiski of the Hydrographical Department at St. Petersburg. Five observations daily. Calculated by the Physical Central Observatory at St. Petersburg.

1	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	YEAR.
Midnight	—0.°59	—0.°91	—1.°56	—2.°13	—2.°56	—2.°69	—1.°47
1	—0. 70	—1. 35	—2. 16	—2. 86	—3. 11	—2. 95	—1. 71
2	—0. 80	—1. 70	—2. 76	—3. 68	—3. 55	—3. 20	—2. 14
3	—0. 90	—2. 01	—3. 37	—4. 44	—3. 87	—3. 36	—2. 43
4	—0. 94	—2. 27	—3. 91	—5. 14	—4. 02	—3. 36	—2. 64
5	—0. 96	—2. 50	—4. 43	—5. 50	—3. 56	—2. 57	—2. 61
6	—1. 02	—2. 64	—4. 70	—4. 94	—2. 59	—1. 61	—2. 34
7	—1. 06	—2. 72	—4. 37	—3. 79	—1. 50	—0. 69	—1. 88
8	—1. 07	—2. 36	—3. 25	—2. 38	—0. 39	0. 20	—1. 18
9	—0. 79	—1. 48	—1. 74	—0. 79	0. 70	1. 03	—0. 31
10	—0. 17	—0. 52	—0. 10	0. 92	1. 70	1. 78	0. 59
11	0. 39	0. 65	1. 80	2. 52	2. 60	2. 50	1. 49
Noon	0. 94	1. 64	3. 30	3. 96	3. 29	3. 09	2. 25
1	1. 48	2. 59	4. 49	4. 92	3. 75	3. 55	2. 85
2	1. 75	3. 21	5. 06	5. 39	4. 00	3. 69	3. 15
3	1. 59	3. 18	4. 74	5. 10	3. 81	3. 41	2. 96
4	1. 33	2. 90	4. 13	4. 47	3. 40	2. 88	2. 58
5	1. 06	2. 41	3. 45	3. 72	2. 74	2. 20	2. 09
6	0. 76	1. 86	2. 68	2. 91	1. 93	1. 40	1. 51
7	0. 41	1. 33	1. 94	2. 02	0. 99	0. 51	0. 91
8	0. 15	0. 81	1. 21	1. 20	0. 14	—0. 39	0. 34
9	—0. 10	0. 39	0. 53	0. 36	—0. 65	—1. 21	—0. 18
10	—0. 32	—0. 03	—0. 14	—0. 48	—1. 34	—1. 90	—0. 66
11	—1. 48	—0. 47	—0. 86	—1. 33	—1. 99	—1. 53	—1. 09

OKHOTSK. HOURLY RANGE OF THE TEMPERATURE.

From the Sapiski of the Hydrographical Department at St Petersburg. Five observations daily. Calculated by the Physical Central Observatory at St. Petersburg.

1	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR.
Midnight	—2.°08	—1.°50	—1.°24	—0.°96	—0.°75	—0.°60	—1.°47
1	—2. 43	—1. 90	—1. 45	—1. 26	—0. 95	—0. 64	—1. 81
2	—2. 75	—2. 30	—1. 65	—1. 54	—1. 14	—0. 65	—2. 14
3	—2. 98	—2. 61	—1. 81	—1. 79	—1. 31	—0. 66	—2. 43
4	—3. 10	—2. 83	—1. 94	—2. 00	—1. 49	—0. 66	—2. 64
5	—2. 43	—2. 70	—2. 09	—2. 21	—1. 64	—0. 69	—2. 61
6	—1. 49	—2. 05	—2. 16	—2. 36	—1. 71	—0. 75	—2. 34
7	—0. 64	—1. 23	—1. 85	—2. 15	—1. 74	—0. 77	—1. 88
8	0. 14	—0. 45	—1. 05	—1. 49	—1. 34	—0. 71	—1. 18
9	0. 85	0. 33	—0. 18	—0. 64	—0. 75	—0. 32	—0. 31
10	1. 50	1. 01	0. 71	0. 21	—0. 07	0. 15	0. 59
11	2. 06	1. 66	1. 44	0. 99	0. 66	0. 63	1. 49
Noon	2. 51	2. 20	2. 01	1. 66	1. 38	1. 01	2. 25
1	2. 89	2. 61	2. 40	2. 20	1. 96	1. 31	2. 85
2	3. 07	2. 80	2. 61	2. 55	2. 20	1. 41	3. 15
3	2. 90	2. 57	2. 44	2. 50	2. 05	1. 21	2. 96
4	2. 47	2. 24	2. 12	2. 26	1. 78	0. 95	2. 58
5	1. 94	1. 84	1. 75	1. 86	1. 43	0. 66	2. 09
6	1. 25	1. 34	1. 25	1. 41	0. 99	0. 36	1. 51
7	0. 52	0. 80	0. 69	0. 96	0. 65	0. 11	0. 91
8	—0. 19	0. 27	0. 16	0. 54	0. 34	—0. 10	0. 34
9	—0. 84	—0. 21	—0. 29	0. 14	0. 05	—0. 30	—0. 18
10	—1. 36	—0. 68	—0. 73	—0. 26	—0. 22	—0. 46	—0. 66
11	—1. 75	—1. 10	—1. 15	—0. 64	—0. 49	—0. 54	—1. 09

NIKOLAJEVSK. HOURLY RANGE OF THE TEMPERATURE.

Cf. My Treatise on the "Climate of the Amoor-Territory," being a part of the book "Reisen und Forschungen in Amur-Lande von L. v. Schrenck" T. IV Page 333.

2	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.
Midnight	—1.°01	—1.°94	—2.°96	—2.°37	—2.°59	—2.°88
1	—1. 22	—2. 27	—3. 51	—2. 78	—2. 27	—3. 31
2	—1. 36	—2. 45	—4. 07	—3. 29	—3. 19	—3. 69
3	—1. 41	—2. 56	—4. 64	—3. 78	—3. 51	—3. 97
4	—1. 57	—2. 85	—5. 24	—4. 17	—3. 64	—3. 96
5	—1. 80	—3. 29	—5. 71	—4. 17	—3. 25	—3. 46
6	—2. 06	—3. 55	—5. 66	—3. 62	—2. 39	—2. 52
7	—2. 21	—3. 80	—4. 61	—2. 07	—1. 29	—1. 32
8	—2. 07	—2. 67	—2. 60	—0. 70	—0. 16	—0. 09
9	—1. 42	—0. 85	0. 04	0. 33	0. 91	0. 98
10	—0. 07	1. 07	2. 15	2. 01	2. 00	1. 99
11	1. 36	2. 67	3. 84	3. 02	2. 89	2. 80
Noon	2. 59	3. 82	4. 81	3. 73	3. 45	3. 49
1	3. 24	4. 76	5. 70	4. 06	3. 81	3. 74
2	3. 41	5. 34	6. 41	4. 23	3. 85	3. 83
3	3. 10	4. 99	6. 27	4. 06	3. 64	3. 89
4	2. 29	4. 25	5. 96	3. 88	3. 30	3. 43
5	1. 35	2. 61	4. 76	3. 23	2. 74	3. 04
6	0. 59	1. 19	2. 96	2. 16	1. 86	2. 29
7	0. 14	—0. 06	1. 21	0. 96	0. 79	1. 33
8	—0. 12	—0. 71	—0. 06	—0. 17	—0. 39	0. 11
9	—0. 24	—0. 94	—0. 84	—1. 00	—1. 49	—1. 07
10	—0. 61	—1. 26	—1. 90	—1. 52	—2. 00	—2. 07
11	—0. 77	—1. 52	—2. 42	—2. 03	—2. 37	—2. 65

NIKOLAJEVSK. HOURLY RANGE OF THE TEMPERATURE

Cf My Treatise on the "Climate of the Amoor-Territory," being a part of the book "Reisen und Forschungen in Amur-Lande von L. v. Schrenck" T. IV Page 333.

2	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
Midnight	—2.°34	—2.°67	—2.°59	—1.°80	—1.°14	—0.°80
1	—2. 56	—2. 94	—2. 95	—1. 99	—1. 33	—0. 97
2	—2. 81	—3. 27	—3. 31	—2. 05	—1. 39	—1. 07
3	—3. 05	—3. 62	—3. 71	—2. 11	—1. 43	—1. 15
4	—3. 09	—3. 84	—4. 10	—2. 31	—1. 54	—1. 29
5	—2. 76	—3. 67	—4. 35	—2. 54	—1. 69	—1. 49
6	—2. 01	—3. 05	—4. 05	—2. 62	—1. 89	—1. 62
7	—1. 20	—1. 19	—3. 47	—2. 44	—2. 15	—1. 75
8	—0. 30	—0. 17	—1. 34	—1. 41	—1. 68	—1. 70
9	0. 51	0. 90	0. 40	0. 00	0. 45	—1. 12
10	1. 42	2. 02	2. 02	1. 31	0. 55	0. 01
11	2. 14	2. 86	3. 25	1. 60	1. 63	1. 27
Noon	2. 69	3. 46	4. 07	3. 06	2. 65	2. 27
1	3. 17	3. 86	4. 62	3. 51	3. 06	2. 96
2	3. 49	4. 07	4. 97	3. 74	3. 06	2. 94
3	3. 29	4. 01	5. 01	3. 59	2. 76	2. 50
4	3. 02	3. 67	4. 54	2. 90	1. 83	1. 65
5	2. 56	3. 00	3. 52	1. 91	0. 90	0. 77
6	1. 86	2. 00	2. 16	0. 96	0. 21	0. 20
7	0. 97	0. 21	0. 77	0. 24	—0. 24	—0. 07
8	—0. 05	—0. 36	—0. 36	—0. 31	—0. 40	—0. 26
9	—1. 02	—1. 44	—1. 19	—0. 77	—0. 55	—0. 35
10	—1. 70	—2. 04	—1. 75	—1. 12	—0. 79	—0. 45
11	—2. 11	—2. 41	—2. 17	—1. 46	—0. 96	—0. 60

PEKING. HOURLY RANGE OF THE TEMPERATURE.

Hourly observations during 1850—1855. (6 years) Cf. My treatise "Ueber das Clima von Peking," page 8.

3	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.
Midnight	—1.°46	—1.°96	—2.°14	—2.°27	—2.°62	—2.°88
1	—1. 86	—2. 40	—2. 71	—2. 90	—3. 24	—3. 48
2	—2. 10	—2. 75	—3. 20	—3. 49	—3. 85	—3. 99
3	—2. 38	—3. 02	—3. 65	—4. 13	—4. 47	—4. 46
4	—2. 62	—3. 30	—4. 00	—4. 69	—5. 07	—4. 93
5	—2. 87	—3. 60	—4. 31	—5. 19	—5. 44	—5. 12
6	—3. 05	—3. 83	—4. 56	—5. 18	—4. 40	—3. 88
7	—3. 18	—3. 94	—4. 17	—3. 88	—2. 93	—2. 58
8	—2. 87	—3. 04	—2. 51	—2. 13	—1. 51	—1. 32
9	—1. 29	—1. 13	—0. 77	—0. 39	—0. 06	0. 11
10	0. 44	0. 65	0. 89	1. 33	1. 42	1. 48
11	1. 79	2. 20	2. 31	2. 77	2. 78	2. 77
Noon	2. 90	3. 16	3. 36	3. 66	3. 76	3. 91
1	3. 65	4. 11	4. 27	4. 54	4. 53	4. 67
2	4. 13	4. 61	4. 86	5. 07	5. 05	5. 13
3	4. 20	4. 78	5. 12	5. 23	5. 22	5. 15
4	3. 68	4. 52	4. 90	4. 96	4. 96	4. 82
5	2. 48	3. 45	4. 04	4. 18	4. 37	4. 17
6	1. 46	2. 15	2. 77	3. 02	3. 32	3. 11
7	0. 84	1. 15	1. 54	1. 66	1. 68	1. 58
8	0. 23	0. 42	0. 58	0. 58	0. 38	0. 19
9	—0. 30	—0. 24	—0. 26	—0. 20	—0. 56	—0. 79
10	—0. 71	—0. 83	—0. 91	—0. 97	—1. 33	—1. 52
11	—1. 12	—1. 39	—1. 50	—1. 61	—1. 98	—2. 17

PEKING. HOURLY RANGE OF THE TEMPERATURE.

Hourly observations during 1850—1855. (6 years) Cf My treatise "Ueber das Clima von Peking," page 8.

3	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
Midnight	—2.°09	—1.°99	—2.°11	—2.°12	—1.°63	—1.°45
1	—2. 51	—2. 37	—2. 55	—2. 64	—1. 94	—1. 72
2	—2. 93	—2. 71	—2. 96	—3. 10	—2. 25	—2. 06
3	—3. 28	—3. 03	—3. 27	—3. 46	—2. 51	—2. 36
4	—3. 59	—3. 34	—3. 61	—3. 88	—2. 70	—2. 56
5	—3. 80	—3. 61	—3. 96	—4. 21	—2. 93	—2. 76
6	—2. 94	—3. 41	—4. 01	—4. 59	—3. 16	—2. 97
7	—1. 88	—2. 30	—2. 98	—4. 10	—3. 23	—3. 17
8	—0. 89	—1. 11	—1. 47	—2. 28	—2. 17	—2. 60
9	0. 14	0. 22	0. 10	—0. 30	—0. 61	—0. 95
10	1. 26	1. 36	1. 49	1. 30	0. 86	0. 74
11	2. 25	2. 25	2. 56	2. 76	2. 09	2. 10
Noon	2. 77	2. 96	3. 59	4. 11	3. 43	3. 20
1	3. 30	3. 47	4. 15	4. 89	3. 96	3. 89
2	3. 67	3. 85	4. 54	5. 31	4. 28	4. 28
3	3. 73	3. 95	4. 58	5. 35	4. 14	4. 20
4	3. 57	3. 69	4. 10	4. 64	3. 40	3. 37
5	3. 11	3. 00	3. 11	3. 30	2. 03	2. 00
6	2. 31	1. 98	1. 70	1. 70	1. 14	1. 06
7	1. 13	0. 70	0. 64	0. 73	0. 52	0. 48
8	0. 07	—0. 15	—0. 08	0. 02	—0. 01	—0. 08
9	—0. 67	—0. 74	—0. 69	—0. 53	—0. 42	—0. 52
10	—1. 20	—1. 17	—1. 17	—1. 07	—0. 82	—0. 85
11	—1. 70	—1. 58	—1. 61	—1. 61	—1. 22	—1. 15

NERCHINSK. HOURLY RANGE OF THE TEMPERATURE.

From the "Repertorium für Meteorologie, herausgegeben von der K. Academie der Wissenschaften zu St. Petersburg" T. I. p. 86, Hourly observations during 21 years 1841—1862.

4	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.
Midnight	—1.°17	—1.°71	—2.°37	—2.°90	—3.°47	—3.°89
1	—1. 45	—2. 16	—2. 86	—3. 35	—4. 04	—4. 51
2	—1. 62	—2. 44	—3. 32	—3. 92	—4. 76	—5. 20
3	—1. 72	—2. 64	—3. 82	—4. 52	—5. 45	—5. 79
4	—1. 90	—3. 00	—4. 37	—4. 95	—5. 74	—5. 91
5	—2. 21	—3. 54	—4. 81	—4. 90	—5. 27	—5. 32
6	—2. 55	—3. 92	—4. 77	—4. 17	—4. 05	—4. 04
7	—2. 69	—3. 72	—3. 95	—2. 81	—2. 27	—2. 20
8	—2. 32	—2. 67	—2. 34	—1. 04	—0. 36	—0. 31
9	—1. 32	—0. 96	—0. 34	0. 74	1. 34	1. 44
10	0. 17	0. 92	1. 52	2. 24	2. 67	2. 77
11	1. 82	2. 55	2. 95	3. 30	3. 65	3. 84
Noon	3. 20	3. 72	3. 96	4. 04	4. 31	4. 59
1	3. 97	4. 51	4. 75	4. 57	4. 76	5. 09
2	4. 05	4. 90	5. 39	4. 96	5. 04	5. 31
3	3. 49	4. 81	5. 67	5. 14	5. 14	5. 30
4	2. 55	4. 07	5. 31	4. 90	4. 96	5. 05
5	1. 50	2. 79	4. 20	4. 14	4. 41	4. 47
6	0. 65	1. 32	2. 60	2. 91	3. 40	3. 50
7	0. 00	0. 16	0. 99	1. 42	1. 95	2. 12
8	—0. 31	—0. 45	—0. 21	—0. 01	0. 31	0. 49
9	—0. 46	—0. 65	—0. 96	—1. 17	—1. 19	—1. 11
10	—0. 61	—0. 81	—1. 45	—1. 97	—2. 29	—2. 37
11	—0. 86	—1. 19	—1. 89	—2. 49	—2. 99	—3. 25

NERCHINSK. HOURLY RANGE OF THE TEMPERATURE

From the "Repertorium fur Meteorologie, herausgegeben von der K. Academie der Wissenschaften zu St. Petersburg" T. I. p. 86, Hourly observations during 21 years 1841—1862.

4	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
Midnight	—3.°52	—3.°16	—2.°81	—2.°14	—1.°26	—0.°97
1	—3. 99	—3. 61	—3. 31	—2. 51	—1. 59	—1. 19
2	—4. 52	—4. 16	—3. 80	—2. 72	—1. 81	—1. 34
3	—5. 02	—4. 72	—4. 32	—2. 99	—2. 01	—1. 49
4	—5. 21	—5. 11	—4. 85	—3. 44	—2. 31	—1. 66
5	—4. 81	—5. 01	—5. 16	—3. 96	—2. 70	—1. 91
6	—3. 74	—4. 27	—4. 71	—4. 19	—3. 04	—2. 21
7	—2. 17	—2. 91	—3. 85	—3. 69	—3. 04	—2. 36
8	—0. 45	—1. 15	—2. 05	—2. 39	—2. 47	—2. 14
9	1. 14	0. 66	0. 07	—0. 57	—1. 29	—1. 31
10	2. 45	2. 25	2. 02	1. 26	0. 35	0. 06
11	3. 45	3. 46	3. 50	2. 79	2. 07	1. 69
Noon	4. 20	4. 32	4. 50	3. 90	3. 47	3. 06
1	4. 71	4. 91	5. 21	4. 65	4. 25	3. 76
2	4. 96	5. 25	5. 70	5. 01	4. 29	3. 64
3	4. 96	5. 32	5. 81	4. 87	3. 67	2. 86
4	4. 67	5. 01	5. 34	4. 12	2. 67	1. 84
5	4. 06	4. 24	4. 21	2. 91	1. 60	0. 92
6	3. 09	3. 05	2. 69	1. 60	0. 72	0. 32
7	1. 79	1. 59	1. 12	0. 55	0. 15	0. 01
8	0. 81	0. 11	—0. 14	—0. 11	—0. 10	—0. 15
9	—1. 12	—1. 15	—1. 04	—0. 55	—0. 29	—0. 30
10	—2. 25	—2. 09	—1. 70	—1. 00	—0. 52	—0. 50
11	—3. 01	—2. 70	—2. 27	—1. 57	—0. 87	—0. 74

SHANGHAI. (ZIKAWEI.) HOURLY RANGE OF THE TEMPERATURE.

Observations made 8 times at 1a.m., 4a.m., 10a.m., 7a.m., 1p.m., 4p.m., 7p.m., 10p.m., during the 12 months April 1875—March 1876.

5	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.
Midnight	—0.°9	—1.°2	—2.°1	—3.°0	—3.°0	—1.°3
1	—1. 0	—1. 3	—2. 3	—3. 2	—3. 3	—1. 4
2	—1. 1	—1. 4	—2. 5	—3. 5	—3. 4	—1. 5
3	—1. 2	—1. 5	—2. 6	—3. 7	—3. 5	—1. 6
4	—1. 3	—1. 7	—2. 7	—3. 8	—3. 6	—1. 7
5	—1. 4	—1. 8	—2. 8	—3. 8	—3. 6	—1. 7
6	—1. 5	—1. 9	—2. 6	—3. 1	—2. 7	—1. 3
7	—1. 6	—1. 9	—1. 9	—1. 9	—1. 4	—0. 8
8	—1. 3	—1. 3	—1. 0	—0. 7	0. 0	—0. 1
9	—0. 3	—0. 1	0. 5	0. 9	1. 5	0. 6
10	0. 8	1. 1	1. 9	2. 7	2. 7	1. 1
11	1. 4	1. 9	2. 7	3. 6	3. 5	1. 6
Noon	1. 9	2. 4	3. 4	4. 4	4. 2	1. 9
1	2. 3	2. 7	3. 8	4. 9	4. 6	2. 0
2	2. 2	2. 6	3. 7	4. 8	4. 4	2. 0
3	1. 9	2. 3	3. 4	4. 5	4. 1	1. 9
4	1. 5	1. 9	2. 9	3. 9	3. 4	1. 8
5	1. 0	1. 3	2. 0	2. 6	2. 3	1. 3
6	0. 5	0. 6	0. 8	1. 1	1. 0	0. 7
7	0. 0	0. 0	0. 0	—0. 1	—0. 1	0. 1
8	—0. 4	0. 4	—0. 7	—1. 0	—1. 0	—0. 3
9	—0. 6	0. 7	—1. 2	—1. 7	—1. 6	—0. 7
10	—0. 7	—0. 9	—1. 5	—2. 2	—2. 2	—0. 9
11	—0. 8	—1. 1	—1. 8	—2. 6	—2. 6	—1. 1

SHANGHAI. (ZIKAWEI.) HOURLY RANGE OF THE TEMPERATURE.

Observations made 8 times at 1a.m., 4a.m., 7a.m., 10a.m., 1p.m. 4p.m., 7p.m., 10p.m., during the 12 months April 1875—March 1876.

5	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.
Midnight	—2.°0	—2.°2	—2.°0	—2.°1	—2.°1	—2.°2
1	—2.2	—2.4	—2.2	—2.3	—2.4	—2.5
2	—2.4	—2.6	—2.4	—2.5	—2.6	—2.7
3	—2.5	—2.7	—2.5	—2.6	—2.8	—3.0
4	—2.6	—2.7	—2.6	—2.7	—3.0	—3.3
5	—2.5	—2.6	—2.4	—2.7	—3.1	—3.6
6	—1.8	—1.9	—1.9	—2.7	—3.2	—3.8
7	—1.0	—0.8	—1.1	—2.1	—2.9	—3.7
8	0.0	0.3	0.0	—0.7	—1.5	2.2
9	1.0	1.4	1.1	1.1	0.7	0.2
10	1.9	2.3	2.2	2.8	2.5	2.3
11	2.7	3.0	2.9	2.5	3.5	3.4
Noon	3.1	3.4	3.2	4.0	4.1	4.3
1	3.4	3.6	3.4	4.1	4.3	4.6
2	3.3	3.4	3.2	4.0	4.3	4.6
3	3.0	3.0	2.9	3.5	3.9	4.3
4	2.6	2.4	2.3	2.7	3.2	3.8
5	1.7	1.5	1.4	1.4	2.1	2.8
6	0.7	0.4	1.3	0.2	0.8	1.5
7	—0.2	—0.6	—0.4	—0.8	—0.3	0.2
8	—0.8	—1.2	—1.0	—1.3	—0.9	—0.5
9	—1.3	—1.7	—1.4	—1.6	—1.3	—1.0
10	—1.6	—2.0	—1.7	—1.8	—1.6	—1.4
11	—1.8	—2.1	—1.9	—2.0	—1.9	—1.8

PETROPAULOVSK. HOURLY RANGE OF THE TEMPERATURE.

Observations five times daily.

6	JAN.	FEB.	MAR.	APR.	MAY.	JUNE.	YEAR.
Midnight	—0.°54	—1.°26	—1.°99	—2.°33	—2.°49	—2.°96	—1.°82
1	—0. 68	—1. 47	—2. 27	—2. 57	—2. 73	—3. 25	—2. 04
2	—0. 80	—1. 67	—2. 49	—2. 79	—3. 01	—3. 51	—2. 23
3	—0. 93	—1. 85	—2. 70	—2. 98	—3. 19	—3. 74	—2. 40
4	—1. 05	—2. 00	—2. 88	—3. 13	—3. 24	—3. 88	—2. 53
5	—1. 17	—2. 14	—2. 98	—3. 12	—2. 84	—3. 45	—2. 48
6	—1. 29	—2. 26	—2. 97	—2. 53	—2. 07	—2. 54	—2. 19
7	—1. 34	—2. 35	—2. 61	—1. 70	—1. 22	—1. 44	—1. 69
8	—1. 35	—2. 00	—1. 70	—0. 63	—0. 28	—0. 22	—0. 96
9	—0. 81	—1. 03	—0. 43	0. 82	0. 71	1. 06	0. 09
10	0. 16	0. 43	1. 09	2. 08	1. 69	2. 26	1. 26
11	1. 10	1. 74	2. 48	2. 97	2. 56	3. 31	2. 30
Noon	1. 79	2. 82	3. 55	3. 62	3. 18	4. 19	3. 08
1	2. 21	3. 60	4. 25	3. 78	3. 60	4. 78	3. 59
2	2. 29	3. 81	4. 57	4. 00	3. 79	5. 05	3. 75
3	1. 91	3. 51	4. 26	3. 67	3. 56	4. 74	3. 43
4	1. 26	2. 66	3. 53	3. 06	3. 10	4. 05	2. 77
5	0. 51	1. 31	2. 39	2. 26	2. 46	2. 91	1. 85
6	0. 14	0. 62	0. 92	1. 13	1. 50	1. 10	0. 79
7	—0. 05	0. 13	0. 15	—0. 03	0. 47	—0. 36	—0. 04
8	—0. 19	—0. 26	—0. 41	—0. 76	—0. 54	—1. 30	—0. 60
9	—0. 30	—0. 55	—0. 88	—1. 27	—1. 22	—1. 87	—1. 00
10	—0. 36	—0. 80	—1. 30	—1. 69	—1. 72	—2. 33	—1. 32
11	—0. 44	—1. 06	—1. 68	—2. 07	—2. 09	—2. 66	—1. 59

PETROPAULOVSK. HOURLY RANGE OF THE TEMPERATURE

Observations five times daily.

	JULY.	AUG.	SEPT.	OCT.	NOV.	DEC.	YEAR.
6							
Midnight	—2.°79	—2.°43	—1.°98	—1.°42	—1.°16	—0.°59	—1.°22
1	—3. 18	—2. 58	—2. 22	—1. 60	—1. 24	—0. 72	—2. 04
2	—3. 54	—2. 70	—2. 43	—1. 75	—1. 29	—0. 83	—2. 23
3	—3. 87	—2. 81	—2. 63	—1. 87	—1. 34	—0. 92	—2. 40
4	—4. 07	—2. 89	—2. 80	—1. 97	—1. 38	—1. 01	—2. 53
5	—3. 73	—2. 88	—2. 94	—2. 04	—1. 42	—1. 09	—2. 48
6	—2. 94	—2. 26	—2. 66	—2. 09	—1. 46	—1. 20	—2. 19
7	—1. 79	—1. 31	—1. 91	—1. 85	—1. 49	—1. 28	—1. 69
8	—0. 53	—0. 24	—0. 93	—1. 10	—1. 25	—1. 29	—0. 96
9	0. 81	0. 85	0. 18	—0. 02	—0. 29	—0. 76	0. 09
10	2. 01	1. 79	1. 41	1. 13	0. 76	0. 30	1. 26
11	3. 15	2. 67	2. 57	2. 12	1. 64	1. 23	2. 30
Noon	4. 06	3. 43	3. 39	2. 78	2. 24	1. 86	3. 08
1	4. 68	4. 00	4. 00	3. 23	2. 60	2. 19	3. 59
2	4. 99	4. 21	4. 25	3. 40	2. 51	2. 10	3. 75
3	4. 75	3. 97	3. 97	3. 01	2. 14	1. 71	3. 43
4	4. 09	3. 36	3. 17	2. 35	1. 55	1. 02	2. 77
5	3. 06	2. 43	2. 08	1. 38	0. 98	0. 49	1. 85
6	1. 44	0. 94	0. 68	0. 37	0. 51	0. 15	0. 79
7	0. 03	—0. 41	—0. 26	—0. 27	0. 13	—0. 03	—0. 04
8	—0. 87	—1. 17	—0. 74	—0. 62	—0. 22	—0. 16	—0. 60
9	—1. 48	—1. 68	—1. 10	—0. 83	—0. 54	—0. 25	—1. 00
10	—1. 98	—2. 08	—1. 36	—1. 03	—0. 84	—0. 35	—1. 32
11	—2. 39	—2. 28	—1. 67	—1. 24	—1. 03	—0. 49	—1. 59

DECIMA. HOURLY RANGE OF THE TEMPERATURE.

Observations for ten years (1845-1855), at 6a.m., 9a.m., 3½p.m., 10.pm. and Hourly One Day every Month.
Cf. Meteorologische Waarnemingen in Nederlanden zijne Bezittingen etz. 1856.

7	WINTER.	SPRING.	SUMMER.	AUTUMN.
Midnight	—1.°90	—1.°98	—1.°90	—1.°84
1	—2. 14	—2. 29	—2. 14	—2. 16
2	—2. 37	—2. 62	—2. 29	—2. 52
3	—2. 51	—2. 84	—2. 20	—2. 73
4	—2. 32	—2. 98	—2. 09	—3. 04
5	—2. 00	—2. 73	—1. 92	—3. 18
6	—1. 61	—2. 10	—1. 50	—2. 47
7	—0. 82	—0. 55	—0. 63	—1. 18
8	0. 04	0. 49	0. 22	0. 31
9	0. 97	1. 06	0. 97	1. 45
10	1. 49	1. 55	1. 26	1. 88
11	1. 74	1. 94	1. 44	2. 26
Noon	1. 95	2. 22	1. 72	2. 56
1	2. 14	2. 47	1. 96	2. 74
2	2. 29	2. 59	2. 09	2. 72
3	2. 38	2. 66	2. 17	2. 69
4	2. 27	2. 41	1. 94	2. 49
5	1. 83	2. 02	1. 63	1. 95
6	1. 19	1. 43	1. 31	1. 30
7	0. 54	0. 80	0. 90	0. 49
8	0. 06	0. 05	0. 09	—0. 14
9	—0. 55	—0. 76	—0. 51	—0. 76
10	—1. 08	—1. 21	—1. 09	—1. 25
11	—1. 58	—1. 57	—1. 51	—1. 55

VICTORIA (HONOKONG). HOURLY RANGE OF THE TEMPERATURE.

One Year; Observations Daily at 7½a.m., 9½a.m., 0½p.m., 3½p.m., 9½p.m.

Cf. Sitzungsberichte der mathematisch—naturwissens chaftlichen Classe der Akademie der Wissenschaften zu Wien. T. 36, 1859, pag. 165.

8	WINTER.	SPRING.	SUMMER.	AUTUMN.
Midnight	—0.8	—1.4	—1.3	—1.7
1	—1.0	—1.6	—1.5	—1.1
2	—1.1	—1.8	—1.7	—1.2
3	—1.1	—1.9	—1.8	—1.3
4	—1.2	—2.0	—1.9	—1.4
5	—1.2	—2.0	—1.9	—1.5
6	—1.3	—1.6	—1.2	—1.5
7	—1.2	—0.8	—0.4	—0.7
8	—0.8	—0.2	0.3	—0.2
9	—0.3	0.4	0.8	0.4
10	0.3	1.1	1.2	0.9
11	0.7	1.6	1.5	1.2
Noon	1.1	2.1	1.7	1.5
1	1.3	2.3	1.8	1.6
2	1.4	2.1	1.8	1.6
3	1.3	1.9	1.7	1.4
4	1.2	1.5	1.4	1.1
5	1.1	1.1	1.1	0.8
6	0.9	0.7	0.8	0.5
7	0.7	0.3	0.4	0.2
8	0.5	—0.1	0.0	0.0
9	0.1	—0.5	—0.3	—0.3
10	—0.3	—0.8	—0.7	—0.6
11	—0.6	—1.1	—1.0	—0.8

From the Tables (4)—(11), I have calculated the elements (12)—(24), in order to reduce the monthly mean temperature, taken from observations, made at different hours every day, by means of (12)—(24) to the mean for twenty-fours, or to the true daily mean.

Reductions for the mean of the daily Maximum and Minimum.

9	Jan.	Feb.	Mar.	Apr.	May.	June.
Okhotsk	—0.°34	—0.°24	—0.°18	+0.°05	+0.°01	—0.°16
Nicolajevsk	—0. 60	—0. 77	—0. 35	—0. 03	—0. 10	+0. 04
Nerchinsk	—0. 68	—0. 49	—0. 43	—0. 09	—0. 20	+0. 30
Peking	—0. 51	—0. 42	—0. 28	—0. 02	+0. 11	—0. 01
Shanghai	—0. 35	—0. 40	—0. 50	—0. 50	—0. 50	—0. 15
,,	—0. 19	—0. 42	—0. 48	—0. 54	—0. 74	—0. 34
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Okhotsk	+0.°01	+0.°01	—0.°22	—0.°09	—0.°23	—0.°32
Nikolajevsk	—0. 20	—0. 11	—0. 33	—0. 56	—0. 45	—0. 60
Nerchinsk	+0. 12	—0. 10	—0. 32	—0. 41	—0. 62	—0. 70
Peking	+0. 03	—0. 17	—0. 28	—0. 38	—0. 52	—0. 55
Shanghai	—0. 40	—0. 45	—0. 40	—0. 70	—0. 55	—0. 40
,,	—0. 89	—0. 86	—0. 88	—0. 82	—0. 50	—0. 43
	Jan.	Feb.	Mar.	Apr.	May.	June.
Petropaulovsk	—0. 47	—0. 73	—0. 80	—0. 43	—0. 27	—0. 58
Decima	+0. 06	+0. 09	+0. 12	+0. 16	+0. 13	+0. 10
Victoria	0. 0			—0. 1		
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Petropaulovsk	—0. 46	—0. 67	—0. 65	—0. 65	—0. 55	—0. 45
Decima	+0. 06	+0. 11	+0. 16	+0. 22	+0. 16	+0. 11
Victoria	0. 0			0. 0		

Reductions for the mean of the hours 4 a.m., 9 a.m., noon, 3 p.m. and 8 p.m.

10	Jan.	Feb.	Mar.	Apr.	May.	June.
Nikolajevsk	—0.°52	—0.°88	—1.°06	—0.°76	—0.°80	—0.°90
Peking	—0. 68	—0. 79	—0. 86	—0. 88	—0. 85	—0. 89
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Nikolajevsk	—0.°67	—0.°83	—1.°00	—0.°81	—0.°78	—0.°12
Peking	—0. 62	—0. 73	—0. 92	—1. 06	—0. 85	—0. 76

Reductions for the mean of the hours 9 a.m. and 3 p.m.

11	Jan.	Feb.	Mar.	Apr.	May.	June.
Shanghai	—0. 8	—1. 1	—1. 9	—2. 7	—2. 8	—1. 2
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Shanghai	—2. 0	—2. 2	—2. 0	—2. 3	—2. 3	—2. 2

Reductions for the mean of 6 a.m., 9 a.m., $3\frac{1}{2}$ p.m., 10 p.m.

12	Jan.	Feb.	Mar.	Apr.	May.	June.
Decima	—0. 15	...	...	—0. 08	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Decima	—0. 12	...	...	—0. 09	...	...

Reductions for the mean of 8 a.m., 1 p.m., 5 p.m. and 11 p.m.

13	Jan.	Feb.	Mar.	Apr.	May.	June.
Nikolajevsk	—0. 44	—0. 79	—1. 36	—1. 14	—1. 00	—1. 03
Peking	—0. 53	—0. 78	—1. 07	—1. 24	—1. 35	—1. 33
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Nikolajevsk	—0. 83	—1. 07	—1. 15	—0. 63	—0. 33	—0. 36
Peking	—0. 95	—0. 94	—1. 03	—1. 07	—0. 65	—0. 53

Reductions for $\frac{7\ a.m. + 2\ p.m. + 2.9\ p.m.}{4}$

14	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking	—0.°08	—0.°05	—0.°04	—0.°20	—0.°25	—0.°24
Decima	—0. 09	...	...	—0. 13	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking	—0.°11	—0.°01	—0.°05	—0.°03	—0.°05	—0.°01
Decima	—0. 11	...	...	—0. 00	...	...

Reductions for the mean of 6 a.m., 1 p.m. and 10 p.m.

15	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking	+0. 04	+0. 18	+0. 40	+0. 54	+0. 40	+0. 24
Shanghai	—0. 03	+0. 03	+0. 10	+0. 13	+0. 10	+0. 07
Decima	+0. 18	+0. 21	+0. 25	+0. 28	+0. 26	+0. 23
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking	+0. 28	+0. 37	+0. 34	+0. 26	+0. 01	+0. 02
Shanghai	0. 00	+0. 10	+0. 07	+0. 13	+0. 17	+0. 20
Decima	+0. 21	+0. 25	+0. 29	+0. 33	+0. 28	+0. 23

Reductions for the mean of 7 a.m., 2 p.m. and 9 p.m.

16	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking	—0. 22	—0. 14	—0. 14	—0. 33	—0. 52	—0. 59
Shanghai	0. 00	0. 00	—0. 20	—0. 40	—0. 47	—0. 17
Decima	—0. 31	...	...	—0. 43	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking	—0. 37	—0. 27	—0. 29	—0. 23	—0. 21	—0. 20
Shanghai	—0. 33	—0. 30	—0. 23	—0. 10	—0. 03	+0. 03
Decima	—0. 32	...	...	—0. 26	...	...

Reductions for the mean of noon and midnight.

17	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking	—0.°7	—0.°6	—0.°6	—0.°7	—0.°6	—0.°5
Shanghai	—0. 5	—0. 6	—0. 6	—0. 7	—0. 6	—0. 3
Victoria	—0. 2	...	...	—0. 4	...	...
Calcutta	—0. 9	—0. 6	—0. 7	—0. 7	—0. 5	—0. 3
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking	—0.°3	—0.°5	—0.°7	—1.°0	—0.°9	—0.°9
Shanghai	—0. 6	—0. 6	—0. 6	—0. 9	—1. 0	—1. 0
Victoria	—0. 2	...	...	—0. 3	...	...
Calcutta	—0. 5	—0. 5	—0. 4	—0. 4	—0. 8	—0. 8

Reductions for the mean of 6 a.m. and 4 p.m.

18	Jan.	Feb.	Mar.	Apr.	May.	June.
Shanghai	0. 0	0. 0	—0. 1	—0. 4	—0. 3	—0. 3
Decima	—0. 3	...	...	—0. 2	...	...
Victoria	0. 0	...	...	0. 0	...	...
Calcutta	—0. 1	—0. 4	—0. 5	—0. 5	—0. 4	—0. 1
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Shanghai	—0. 4	—0. 3	—0. 2	0. 0	0. 0	0. 0
Decima	—0. 2	...	...	0. 0	...	...
Victoria	—0. 1	...	...	+0. 2	...	...
Calcutta	+0. 1	+0. 1	+0. 1	+0. 1	+0. 1	0. 0

Reductions for the mean of 7 a.m. and 2½ p.m.

19	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking	—0.°5	—0.°4	—0.°5	—0.°7	—1.°2	—1.°3
Shanghai	—0. 2	—0. 3	—0. 8	—1. 4	—1. 4	—0. 6
Victoria	—0. 1	...	...	—0. 6	...	...
Calcutta	—0. 5	—0. 3	—0. 6	—0. 8	—1. 0	—0. 5
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking	—0.°9	—0.°8	—0.°8	—0.°6	—0.°5	—0.°5
Shanghai	—1. 1	—1. 2	—1. 0	—0. 9	—0. 6	—0. 4
Victoria	—0. 7	...	...	—0. 4	...	...
Calcutta	—0. 2	—0. 4	—0. 3	—0. 7	—0. 4	—0. 5

Reductions for the mean of 7½ a.m., 9½ a.m., ½ p.m., 3½ p.m., 9½ p.m.

20	Jan.	Feb.	Mar.	Apr.	May.	June.
Shanghai	—0. 5	—0. 6	—1. 0	—1. 5	—1. 5	—0. 7
Victoria	—0. 3	—0. 4	—0. 6	—0. 7	—0. 7	—0. 8
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Shanghai	—1. 1	—1. 2	—1. 1	—1. 2	—1. 1	—1. 2
Victoria	—0. 8	—0. 7	—0. 6	—0. 5	—0. 5	—0. 4

Reductions for the mean of 7 a.m., 1 p.m., 9 p.m.

21	Jan.	Feb.	Mar.	Apr.	May.	June.
Decima	—0. 3	...	...	—0. 4	...	...
Victoria	—0. 1	...	...	—0. 3	...	...

21	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Decima	—0.°3	...	...	—0.°3	...	...
Victoria	—0. 4...	...	...	—0. 2	...	...

The reductions (12)—(24), concerning the same combination of hours and different places of Eastern Asia, seldom differ much one from the other and therefore it is permitted, to use in the reduction of one place in Eastern Asia, the reduction of an adjoining place, or a combination of the reductions of neighbouring places.

To find an exact expression of connection between this element of reduction and the Geagraphical position I believe the present number of observations too small.

The following two tables (25) and (26) contain the mean daily amplitude of the temperature i.e. the difference between the monthly mean of all the lowest temperatures, observed every day during the month in the morning at the time of the daily Minimum, and the monthly mean of all the highest temparatures, observed in the afternoon at the time of the daily Maximum, [Cf. Tables (27)—(30).]

MEAN DAILY AMPLITUDE ON THE TEMPERATURE.

CONTINENT OF EASTERN ASIA.

22	Jan.	Feb.	Mar.	Apr.	May.	June.
Okhotsk	2.°8	6.°0	9.°8	10.°9	8.°0	7.°1
Nicolajevsk	5. 6	9. 2	12. 1	8. 4	7. 5	7. 9
Nerchinsk	6. 8	8. 9	10. 5	10. 2	10. 8	11. 3
Si-wan-tsz	14. 5	14.3	13. 1	13. 8	13. 1	12. 4
New-chwang	8. 3	9· 6	9. 7	8. 5	7. 3	6. 6
Peking	7. 4	4. 7	9. 7	10. 4	10. 7	10. 8
Shanghai	3. 9	4. 6	6. 6	8. 7	8. 2	3. 7
Fu-cheu-foo	...	...	...	5. 6	4. 9	7. 1
Bangkok	8. 4	7. 5	6. 7	6. 5	5. 7	5. 1

22	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Okhotsk	6.°2	5.°6	4.°7	5.°0	4.°0	2.°2	6. 0
Nikolajevsk	6. 6	7. 9	9. 4	6. 4	5. 2	4. 7	7. 6
Nerchinsk	10. 3	10. 4	11. 0	9. 2	7. 5	6. 1	9. 4
Si-wan-tsz	11. 6	11. 5	11. 4	11. 3	12. 4	13. 5	12. 8
New-chwang	5. 1	5. 8	7. 5	7. 8	5. 3	5. 9	7. 3
Peking	7. 5	7. 6	8. 6	9. 9	7. 5	7. 5	8. 8
Shanghai	6. 0	6. 3	6. 0	6. 8	7. 5	8. 4	6. 4
Fu-cheu-foo	6. 1	6. 4	5. 9	6. 7	5. 2	7. 4	...
Bangkok	5. 1	4. 9	4. 7	4. 4	4. 8	6. 3	5. 8

THE ISLANDS OF EASTERN ASIA.

23	Jan.	Feb.	Mar.	Apr.	May.	June.
Petropaulovsk	3.°6	6.°2	7.°6	7.°1	7.°0	8.°9
Yokohama	10. 5	7. 6	7. 4	7. 8	7. 6	6. 3
Decima	4. 9	5. 1	5. 3	5. 6	5. 2	4. 8
Kelung	2. 6	3. 1	4. 3	3. 5	4. 2	5. 2
Victoria	4. 2	4. 7	4. 7	4. 3	4. 1	3. 7

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
Petropaulovsk	9.°1	7.°1	7.°2	5.°5	4.°1	3.°5	6.°3
Yokohama	5. 1	7. 2	6. 2	7. 8	7. 7	7. 3	7. 4
Decima	4. 5	5. 0	5. 5	5. 9	5. 6	5. 3	5. 3
Kelung	5. 3	4. 0	4. 4	3. 5	3. 3	3. 8	3. 9
Victoria	3. 7	3. 7	3. 7	3. 5	4. 2	4. 0	4. 0

The amplitudes of Okhotsk, Nikolajevsk, Peking, Shanghai, Petropaulovsk and Decima are calculated by means of Tables (1)—(17).

The amplitude of Si-wan-tse is determined by the following formula (78) i.e. by means of the well known amplitude of Peking, and is probably not very exact, because the position of Siwantse is 1158 metres higher than that of Peking, and at Siwantse temperature has been observed only during two years three times daily at 7a. m., 1p. m., and 8p. m.

The amplitude of Newchwang is the mean of two years observations, namely 1862 [c. Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie T. VII p. 7] and 1872 [Cf. our Table (83); the mean difference 3.p m.—4a. m., observed at Newchwang, I have corrected to the true amplitude by the help of our Table (4)].

The amplitude of Fu-cheu-foo is determined by a Maximum and Minimum Thermometer, but of the corrections and construction of this instrument, I have no information. The amplitude of Bangkok I have taken from "Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie T. VII."

Yokohama—Table (26)—is the mean of the two years 1860 and 1865, published in "Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie T. VII p. 47 and T. IX p. 62." The amplitude of the year 1860 is derived from observations, taken at sunrise and 2 p.m., and in the year 1865 the amplitude is determined by the thermograph.

Ths daily amplitude of Kelung I have calculated from observations with thermographs, whose corrections have been determined by thermometers of quicksilver.

Finally the daily amplitude of Victoria (Hongkong) is a combination of Table (8) and six yearly observations printed in "Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie T. VIII p. 72."

At all places of the Northern Hemisphere, as for example in the greatest part of Europe and Western Siberia, where the humidity of the air and the quantity of precipitation (Rain and Snow) in different seasons is not very different, the monthly range of the mean daily amplitude of the temperature stands in close connexion with the yearly course of the sun. The amplitude rises with the height of the sun, and diminishes with the sun's height; i.e. the amplitude arrives at *one* Minimum in December and *one* Maximum between June and July.

More complicated is the annual period of the mean daily amplitude of the temperature if the annual amplitude of the humidity and quantity of precipitation (Rain and Snow) and of the cloudiness, as for instance in Eastern Asia, becomes considerable.

In the Amoor Territory, eastern Mongolia and northern China, where precipitation in winter and spring is rare and insignificant, the daily amplitude of the temperature increases [as exhibited in table (25)] with the height of the sun above the horizon, but at the same time this increase of the amplitude of temperature will be retarded in consequence of the increase of the quantity of precipitation and cloudiness from winter to summer, and will be changed in summer, when rain is abundant, into a decrease.

In autumn the humidity of the air, and the quantity of rain and cloudiness decreases, but the sun has not yet lost much of his force and in consequence of these circumstances the daily amplitude of temperature increases.

Therefore we have in the Amoor-Territory, eastern Mongolia and northern China two Minima of the daily amplitude of temperature—one in winter and one in summer,—and two Maxima—one in spring and one in autumn. In southern China and southern Japan this law holds good, but in less extension, because the yearly periodicity of the daily amplitude of temperature has become blunted and changed by the ample rains of spring and autumn *cf.* table (313) and (314) J.

For example at Yokohama and Bangkok the amplitude, according to tables (25) and (26), has only *one* Maximum in winter and one Minimum in summer; Decima and Victoria have two Minima but the absolute change is insignificant.

At Kelung the greatest rainfall occurs in winter and the smallest in summer; to the same period belongs the cloudiness, and, for this reason the daily amplitude of temperature reaches its Minimum in winter and Maximum in summer.

The amount of the daily amplitude of the temperature in the Amoor Territory, and northern China (for instance at Peking) as far as the 35th degree of latitude, is more considerable than in Southern China and the southern islands of Japan. The principal cause of this is doubtless the greater mass of rain, the greater humidity, and in consequence the greater cloudiness of the sky of those countries, situated to the South of latitude 35.°

The greatest of all amplitudes are observed at Nerchinsk 9.°4—and at Si-wan-tse—12.°8—,places, respectively 592 and 1195 metres

above the sea-level. In accordance with this it seems, that the mean daily amplitude of temperature increases with the height; because Peking, having the amplitude 8.°8 and a height over the sea-level of only 37 metres, is distant only 200 kilometres from Si-wan-tsz. Going from Europe to the East in the same latitude, the daily amplitude of temperature generally increases, because the character of the climate becomes more and more continental.

Therefore for the same latitude on the continent of Eastern Asia the daily amplitude of temperature on an average is a little greater than in Europe. For proof of this statement I propose to compare St. Petersburg with Okhotsk, and Peking with Palermo and Tiflis.

The hours of appearance of the daily Minima, Maxima and Media of temperature, calculated on our tables (1)—(18) are as follow:

TIMES OF THE DAILY MINIMA OF THE TEMPERATURE.

CONTINENT OF EASTERN ASIA.

Forenoon.

24

	Jan.	Feb.	Mar.	Apr.	May.	June.
Okhotsk	7.h4	6.h8	5.h9	4.h7	3.h8	3.h7
Nikolajevsk	7. 0	7. 2	5. 2	4. 5	3. 8	3. 5
Nerchinsk	6. 8	6. 2	5. 3	4. 4	4. 0	3. 7
Peking	6. 7	6. 7	5. 8	5. 4	4. 7	4. 7
Shanghai	6. 5	6. 5	4. 8	4. 3	4. 5	4. 3

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Okhotsk	3.h7	4.h3	5.h6	5.h8	6.h6	6.h8	5.h4
Nikolajevsk	3. 7	4. 0	4. 9	5. 8	6. 8	7. 3	5. 3
Nerchinsk	3. 9	4. 3	5. 1	5. 9	6. 5	7. 0	5. 3
Peking	4. 7	5. 3	5. 5	5. 8	7. 0	6. 9	5. 8
Shanghai	4. 0	3. 5	3. 7	4. 5	5. 7	6. 3	4. 9

THE ISLANDS OF EASTERN ASIA.

Forenoon.

25	Jan.	Feb.	Mar.	Apr.	May.	June.	
Petropaulovsk	7.h4	6.h8	5.h5	4.h3	3.h8	3.h7	
Decima	3. 0	3. 3	3. 6	3. 9	3. 4	3. 0	
Victoria	6. 0	5. 5	5. 0	4. 5	4. 5	4. 4	
	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.
Petropaulovsk	3.h7	4.h3	4.h7	5.h5	6.h2	7.h3	5.h3
Decima	2. 5	3. 2	4. 0	4. 7	4. 1	3. 5	3. 5
Victoria	4. 3	4. 6	4. 9	5. 3	5. 5	5. 8	5. 0

TIMES OF THE DAILY MAXIMA OF THE TEMPERATURE.

CONTINENT OF EASTERN ASIA.

Afternoon.

26	Jan.	Feb.	Mar.	Apr.	May.	June.	
Okhotsk	2.h2	2.h5	2.h5	2.h5	2.h2	1.h8	
Nikolajevsk	1. 7	2. 2	2. 5	2. 0	1. 8	2. 5	
Nerchinsk	1. 6	2. 3	3. 0	3. 0	2. 9	2. 5	
Peking	2. 7	2. 9	3. 1	2. 9	2. 8	2. 6	
Shanghai	1. 4	1. 4	1. 4	1. 5	1. 5	1. 5	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Okhotsk	2.h2	1.h9	2.h2	2.h3	2.h3	1.h7	2.h2
Nikolajevsk	2. 2	2. 3	2. 7	2. 1	1. 5	1. 3	2. 1
Nerchinsk	2. 5	2. 7	2. 7	2. 2	1. 5	1. 3	2. 3
Peking	2. 8	2. 8	2. 8	2. 7	2. 3	2. 3	2. 7
Shanghai	1. 4	1. 0	1. 0	1. 0	1. 4	1. 5	1. 3

THE ISLANDS OF EASTERN ASIA.

Afternoon.

27	Jan.	Feb.	Mar.	Apr.	May.	June.	
Petropaulovsk	1.h7	1.h8	2.h0	1.h6	1.h8	1.h8	
Decima	2. 9	2. 9	2. 8	2. 8	2. 8	2. 8	
Victoria	2. 0	1. 7	1. 4	1. 0	1. 2	1. 4	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Petropaulovsk	2.h2	1.h9	1.h9	1.h7	1.h3	1.h3	1.h7
Decima	2. 8	2. 4	2. 0	1. 5	2. 0	2. 4	2. 5
Victoria	1. 5	1. 5	1. 5	1. 5	1. 7	1. 9	1. 5

TIMES OF THE DAILY MEDIA OF THE TEMPERATURE.

CONTINENT OF EASTERN ASIA.

Forenoon.

28	Jan.	Feb.	Mar.	Apr.	May.	June.	
Okhotsk	10.h3	10.h4	10.h1	9.h5	8.h3	7.h8	
Nikolajevsk	10. 0	9. 4	9. 0	8. 7	8. 2	8. 1	
Nerchinsk	9. 9	9. 5	9. 2	8. 6	8. 2	8. 2	
Peking	9. 8	9. 6	9. 5	9. 2	9. 0	8. 9	
Shanghai	9. 3	9. 1	8. 7	8. 4	8. 0	8. 1	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Okhotsk	7.h8	8.h6	9.h2	9.h8	10.h1	9.h7	9.h3
Nikolajevsk	8. 4	8 2	8. 8	9. 0	8. 8	10. 0	8. 9
Nerchinsk	8. 3	8. 6	9. 0	9. 3	9. 8	10. 0	9. 0
Peking	8. 9	8. 8	8. 9	9. 2	9. 4	9. 6	9. 2
Shanghai	8. 0	7. 7	8. 0	8. 4	8. 7	8. 9	8. 4

THE ISLANDS OF EASTERN ASIA.

Forenoon.

29	Jan.	Feb.	Mar.	Apr.	May.	June.	
Petropaulovsk	9.h8	9.h7	9.h3	8.h4	8.h3	8.h2	
Decima	8. 0	...	...	7. 5	...	...	
Victoria	9. 5	...	...	8. 3	...	...	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Petropaulovsk	8.h4	8.h2	8.h8	9.h0	9.h3	9.h7	8.h9
Decima	7. 7	...	...	7. 8	...	...	7. 7
Victoria	7. 5	...	...	8. 3	...	...	8. 4

TIMES OF THE DAILY MEDIA OF THE TFMPERATURE.

CONTINENT OF EASTERN ASIA.

Afternoon.

30	Jan.	Feb.	Mar.	Apr.	May.	June.	
Okhotsk	8.h6	9.h9	9.h0	9.h4	8.h2	7.h6	
Nikolajevsk	7. 5	7. 0	8. 0	7. 9	7. 7	8. 1	
Nerchinsk	7. 0	7. 3	7. 8	8. 0	8. 2	8. 3	
Peking	8. 4	8. 6	8. 7	8. 7	8. 4	8. 2	
Shanghai	7. 0	7. 0	7. 0	6. 9	6. 9	7. 2	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Okhotsk	7.h7	8.h6	8.h4	9.h3	9.h2	7.h5	8.h7
Nikolajevsk	8. 0	7. 7	7. 7	7. 4	6. 5	6. 7	7. 5
Nerchinsk	8. 2	8. 1	7. 9	7. 8	7. 6	7. 1	7. 8
Peking	8. 1	7. 8	7. 9	8. 0	8. 0	7. 9	8. 2
Shanghai	6. 8	6. 4	6. 4	6. 2	6. 7	7. 3	6. 8

THE ISLANDS OF EASTERN ASIA.

Afternoon.

31	Jan.	Feb.	Mar.	Apr.	May.	June.	Year.
Petropaulovsk	6.h7	7.h3	7.h3	7.h0	7.h5	6.h8	7.h0
Decima	8. 1	...	...	8. 1	...	...	8. 1
Victoria	9. 2	...	...	7. 8	...	...	8. 2
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Petropaulovsk	7.h0	6.h7	6.h7	6.h6	7.h4	6.h8	7.h0
Decima	8. 1	...	...	7. 8	...	...	8. 0
Victoria	8. 0	...	...	8. 0	...	...	8. 2

The hours of appearance of the daily Minima—tables (24) and (25)—vary, as is usual, very much with the season, occurring during the summer several hours earlier than in the winter. In high latitudes (for instance at Okhotsk) in winter the Minimum was observed 1—2 hours before sunrise, in spring and autumn exactly at sunrise, and in summer about one hour after sunrise.

The annual amplitude of the hour of sunrise on the latitude 60° being $6\frac{1}{2}$ hours, the annual amplitude of the hour of the Minimum of temperature is only 3.7 hours.

In lower latitudes the hour of the Minimum of temperature varies much less than in higher latitudes, because the time of sunrise does not change so much.

At Peking (latitude 40°) the annual amplitude of the time of the Minimum of temperature is only two hours: in summer the time of the Minimum of temperature coincides with the sunrise and in the winter it appears $\frac{1}{3}$ hour before the sunrise.

The hours of the Maxima of temperature—tables (26) and (27)—vary in the course of a year not so much as the hours of the Minima: either the time of the Maximum scarcely varies at all, or it appears in summer a little later than in winter.

Also the influence of the geographical position on the time of the Maximum seems to be very small.

The Medium of the morning—tables (28) and (29)—appears in summer much earlier than in winter; but the Medium of the evening, following after the Maximum in the afternoon,—tables (33) and (34)—is more constant during the year.

The number of hours between the appearance of the Medium of the evening and morning, is on an average of the year:

32	At Okhotsk	11.h4
	„ Nicolajevsk	10. 6
	„ Nerchinsk	10. 8
	„ Peking	11. 0
	„ Shanghai	10. 4
	„ Petropaulovsk	10. 1
	„ Decima	12. 3
	„ Victoria	11. 8
	Mean	11. 0

On the continent as well as on the islands of eastern Asia, the time of the temperature remaining above the Medium is two hours less than the time it stops under the Medium.

b. The ABSOLUTE MAXIMA AND MINIMA of the temperature.

To the following tables—(33) and (58)—of observed absolute Maxima and Minima of temperature in Eastern Asia I have added, for the sake of comparison, the data for St. Petersburg, Jekaterinenburg and Barnaul, in tables (59), (60) and (61).

Moreover I have calculated the differences between the absolute Maximum and Minimum, and these differences compiled in the tables (62) and (63).

I call "Monthly and Annual absolute Minimum of the Temperature" not the *lowest* of all the lowest temperature, observed every year during a long (indefinite) period, for instance 100 years—as the denomination *absolute* has been used before (*cf.* for instance Lehrbuch der Meteorologie von Kârntz T. n pag. 45)—but the *mean* of all the lowest temperatures, observed during any series of years. The first quantity is indeterminate, but the latter is a well defined meteorological element, because it can be well determined by observations, made during a small number of years, and can be applied for comparison of different Climates.

On the same account, in the following tables (33)—(61) the absolute Maximum of the temperature "is not the *highest* of all the highest" temperatures, observed every year during a long period, but the *mean* of all the highest temperatures of different years.

ABSOLUTE MAXIMA AND MINIMA OF THE TEMPERATURE.

YAKUTSK.

33	Max.	Min.	Diff.
	15 Years (1829—1843).		
January to December	......	......	......
Year....................................	32.°1	—52.°1	84.°2

UDSKOI.

34	Max.	Min.	Diff.
	1 Year (1844—45). Wesselovsky p. 91 and 97.		
January to December	......	......	......
Year....................................	37.°1	—41.°2	78.°3

35 NICOLAJEVSK. / 36 URGA.

	Max.	Min.	Diff.	Max.	Min.	Diff.
	12 Years (1857—1872).			$2\frac{2}{3}$ Years (1872—1874).		
Jan. ...	—12.°1	—38.°5	26.°4	—10.°2	—40.°2	30.°0
Feb. ...	— 7. 0	—35. 0	28. 0	— 4. 8	—33. 2	28. 4
Mar. ...	0. 2	—31. 1	31. 3	10. 1	—29. 1	39. 2
April	8. 6	—19. 0	27. 6	21. 1	—14. 0	35. 1
May ...	15. 5	— 3. 7	19. 2	28. 7	— 7. 8	36. 5
June...	23. 2	3. 0	20. 2	33. 0	3. 2	29. 8
July ...	27. 5	8. 9	18. 6	31. 3	8. 0	23. 3
Aug....	27. 1	7. 9	19. 2	27. 5	4. 3	23. 2
Sept.	20. 9	—0. 7	21. 6	23. 6	— 4. 1	27. 7
Oct. ...	15. 6	—11. 4	27. 0	16. 5	—17. 7	34. 2
Nov....	2. 9	—24. 6	27. 5	8. 8	—29. 8	38. 6
Dec. ...	— 5. 4	—36. 0	30. 6	— 5. 7	—38. 6	32. 9
Year...	28. 2	—39. 7	67. 9	34. 0	—40. 2	74. 2

37 NERCHINSK. / 38 VLADIVOSTOK.

	Max.	Min.	Diff.	Max.	Min.	Diff.
	3 Years (1872—1874).			1 Year (1874).		
Jan. ...	—16.°6	—43.°7	27.°1	0. 6	—28. 8	29. 4
Feb. ...	— 6. 6	—34. 8	28. 2	3. 1	—21. 2	24. 3
Mar....	4. 8	—28. 7	33. 5	9. 0	—15. 6	24. 6
April	16. 3	—11. 5	27. 8	19. 4	— 4. 0	23. 4
May ...	24. 4	— 2. 6	27. 0	18. 1	0. 0	18. 1
June...	30. 3	5. 6	24. 7	28. 8	6. 9	21. 9

NERCHINSK & VLADIVOSTOK,—*Continued.*

	Max.	Min.	Diff.	Max.	Min.	Diff.
July ...	30.°4	11.°7	18.°7	32.°3	12.°0	20.°3
Aug....	26. 0	6. 3	19. 7	29. 0	13. 7	15. 3
Sept.	22. 6	— 5. 6	28. 2	23. 1	4. 4	18. 7
Oct. ...	14. 8	—16. 7	31. 5	19. 4	— 3. 1	22. 5
Nov....	3. 4	—30. 6	34. 0	9. 3	—16. 9	26. 2
Dec....	— 9. 5	—43. 3	33. 8	4. 3	—25. 0	29. 3
Year...	30. 9	—44. 7	75. 6	32. 3	—28. 8	61. 1

39 SI-WAN-TSE. 40 NEW-CHWANG.

	Max.	Min.	Diff.	Max.	Min.	Diff.
	2 Years (Sept. 1873—Sept. 1875).			2 Years (1862 and 1872).		
Jan. ...	0.°9	—31.°1	32.°0	2.°2	—22.°7	24.°9
Feb....	5. 0	—26. 1	31. 1	6. 9	—17. 5	24. 4
Mar....	13. 6	—16. 6	30. 2	13. 0	—12. 0	25. 0
April	19. 5	—10. 6	30. 1	23. 3	— 2. 8	26. 1
May ...	26. 0	— 2. 1	28. 1	26. 6	5. 8	20. 8
June...	32. 8	8. 5	24. 3	29. 4	12. 7	16. 7
July ...	28. 7	11. 3	17. 4	32. 0	18. 9	13. 1
Aug....	30. 3	9. 5	20. 8	32. 2	15. 8	16. 4
Sept.	23. 6	— 0. 8	24. 4	26. 6	7. 5	19. 1
Oct. ...	18. 0	—14. 7	32. 7	21. 4	— 0. 8	22. 2
Nov....	9. 4	—21. 7	31. 1	15. 2	— 8. 6	23. 8
Dec....	7. 8	—26. 7	34. 5	6. 9	—19. 2	26. 1
Year...	32. 8	—31. 1	63. 9	32. 8	—22. 7	55. 5

41 PEKING. 42 TIENTSIN.

	Max.	Min.	Diff.	Max.	Min.	Diff.
	23 Years (1841—1874.)			1 Year (1872).		
Jan....	6.°0	—14.°4	20.°4	7.°2	—10.°2	17.°4
Feb....	11. 3	—12. 5	23. 8	11. 0	— 6. 5	17. 5
Mar....	19. 5	— 6. 6	26. 1	14. 1	— 0. 9	15. 0
April	27. 9	0. 4	27. 5	23. 5	4. 7	18. 8
May ...	33. 4	8. 0	25. 4	28. 1	11. 2	16. 9
June...	35. 4	14. 5	20. 9	31. 2	18. 1	13. 1
July ...	35. 0	18. 3	16. 7	34. 4	22. 5	11. 9
Aug....	32. 8	16. 5	16. 3	33. 4	20. 3	13. 1
Sept.	30. 3	9. 8	20. 5	27. 5	14. 0	13. 5
Oct. ...	24. 4	0. 6	23. 8	25. 6	5. 0	20. 8
Nov....	16. 1	— 7. 1	23. 2	19. 8	— 3. 0	22. 8
Dec....	8. 7	—12. 4	21. 1	13. 2	— 9. 4	22. 6
Year...	36. 3	—15. 3	51. 6	34. 4	—10. 2	44. 6

43 TAKU. 44 SHANGHAI.

	Taku Max.	Taku Min.	Taku Diff.	Shanghai Max.	Shanghai Min.	Shanghai Diff.
	3 Years (1873—1875).			1Year(Apr.1875—Mar.1876).		
Jan....	3.°1	—12.°4	15.°5	9.°0	— 8.°2	17.°2
Feb....	10. 0	—10. 7	20. 7	14. 4	— 1. 8	16. 2
Mar....	16. 0	— 6. 2	22. 2	......	......	......
April	27. 1	2. 2	24. 9	31. 0	2. 0	29. 0
May ...	32. 9	10. 7	22. 2	33. 0	7. 6	25. 4
June...	36. 8	17. 5	19. 3	31. 8	14. 7	17. 1
July ...	34. 0	20. 2	13. 8	38. 9	21. 7	17. 2
Aug....	34. 8	17. 9	16. 9	36. 4	16. 8	19. 6
Sept.	29. 9	11. 9	18. 0	33. 0	13. 5	19. 5
Oct. ...	21. 7	0. 6	21. 1	29. 0	7. 5	21. 5
Nov....	14. 3	— 6. 0	20. 3	23. 1	— 1. 8	24. 9
Dec....	6. 1	—11. 8	17. 9	18. 0	— 8. 2	26. 2
Year...	37. 2	—12. 7	49. 9	38. 9	— 8. 2	47. 1

45 FU-CHEU-FOO. 46 CANTON

	Fu-cheu-foo Max.	Fu-cheu-foo Min.	Fu-cheu-foo Diff.	Canton Max.	Canton Min.	Canton Diff.
	9 Months (1871).			2 Years (1829—30).		
Jan. ...	......	......	......	21.°1	0.°8	20.°3
Feb....	......	......	......	22. 2	6. 9	15. 3
Mar....	......	......	......	25. 4	7. 7	17. 7
April	31.°6	12.°7	18.°9	28. 0	16. 3	11. 7
May ...	32. 7	15. 5	17. 2	31. 9	18. 3	13. 6
June...	36. 1	20. 5	15. 6	33. 3	24. 0	9. 3
July ...	36. 1	24. 3	11. 8	33. 6	23. 0	10. 6
Aug....	34. 7	21. 1	13. 6	33. 0	24. 3	8. 7
Sept.	32. 7	18. 3	14. 4	32. 2	20. 5	11. 7
Oct. ...	31. 9	13. 0	18. 9	29. 4	15. 5	13. 9
Nov. ...	26. 9	5. 8	21. 1	24. 3	9. 7	14. 6
Dec....	24. 6	1. 1	23. 5	21. 1	4. 7	16. 4
Year...	36. 1	1. 1	35. 0	33. 9	0. 6	33. 3

BANGKOK.

47

	Max.	Min.	Diff.
	8 Years (1840—1847).		
January to December	......	......	......
Year	36.°2	12.°0	24.°2

	48 DUI.			49 HAKODATE.		
	MAX.	MIN.	DIFF.	MAX.	MIN.	DIFF.
	1 Year (1874).			5 Years (1859—60, 1868—70).		
Jan. ...	—6.°9	—22.°5	15.°6	9.°7	—16.°7	26.°4
Feb. ...	0. 0	—19. 4	19. 4	8. 1	—14. 7	22. 8
Mar. ...	3. 1	—16. 2	19. 3	15. 6	—10. 6	26. 2
April	7. 5	—10. 0	17. 5	18. 9	— 4. 7	23. 6
May ...	17. 5	— 3. 1	20. 6	21. 7	— 0. 6	22. 3
June...	19. 1	5. 6	13. 5	25. 6	5. 8	19. 8
July ...	22. 5	9. 5	13. 4	27. 2	9. 2	18. 0
Aug. ...	22. 5	11. 2	11. 3	28. 9	12. 2	16. 7
Sept.	20. 0	8. 7	11. 3	27. 2	7. 5	19. 7
Oct. ...	13. 7	— 5. 6	19. 3	22. 8	1. 1	21. 7
Nov. ...	3. 7	—17. 6	21. 3	15. 6	—6. 1	21. 7
Dec. ...	—2. 5	—26. 6	24. 1	11. 1	—13. 3	24. 4
Year...	22. 5	—26. 6	49. 1	28. 9	—16. 7	45. 6

	50 NIEGATA.			51 YEDO.		
	MAX.	MIN.	DIFF.	MAX.	MIN.	DIFF.
	2 Years (1870—1871).			2 Years (1872—1874).		
Jan. ...	9°	—9°	18°	11.°2	—6.°2	17.°4
Feb. ...	7	—7	14	13. 9	—4. 5	18. 4
Mar. ...	21	—4	25	20. 4	—4. 3	24. 7
April	21	2	19	23. 0	1. 7	21. 3
May ...	28	9	19	27. 0	5. 3	21. 7
June...	31	11	20	28. 9	13. 1	15. 8
July ...	35	18	17	31. 3	16. 6	14. 7
Aug. ...	35	20	15	33. 0	18. 6	14. 4
Sept.	32	14	18	29. 1	14. 1	15. 0
Oct. ...	25	7	18	23. 4	5. 5	17. 9
Nov. ...	19	4	15	19. 7	—1. 0	20. 7
Dec. ...	12	—1	13	17. 7	—4. 0	21. 7
Year...	36	—9	45	33. 0	—6. 2	39. 2

	52 YOKOHAMA.			53 DECIMA.		
	MAX.	MIN.	DIFF.	MAX.	MIN.	DIFF.
	7 Years (1863—1869).			10 Years (1845—1855).		
Jan. ...	14.°8	—3.°2	18.°0	16.°1	—1.°3	17.°4
Feb. ...	13. 4	—2. 8	16. 2	15. 0	—1. 9	16. 9
Mar. ...	18. 9	0. 0	18. 9	17. 6	0. 8	16. 8
April	22. 4	5. 3	17. 1	22. 1	4. 4	17. 7
May ...	25. 0	8. 9	16. 1	25. 5	11. 4	14. 1
June...	27. 7	13. 4	14. 3	27. 4	15. 8	11. 6

YOKOHAMA & DECIMA,—*Continued.*

	Max.	Min.	Diff.	Max.	Min.	Diff.
July ...	30.°6	17.°7	12.°9	30.°9	19.°5	11.°4
Aug....	31. 1	20. 1	11. 0	31. 1	21. 9	9. 2
Sept.	29. 4	15. 1	14. 3	30. 3	17. 6	12. 7
Oct. ...	23. 4	8. 4	15. 0	26. 3	9. 4	16. 9
Nov. ...	20. 3	1. 5	18. 8	21. 2	2. 8	18. 4
Dec. ...	16. 1	—2. 4	18. 5	16. 2	—0. 3	16. 5
Year...	31. 4	—4. 4	35. 8	31. 6	—2. 4	34. 0

54 KEELUNG. 55 VICTORIA, (Hongkong).

	Max.	Min.	Diff.	Max.	Min.	Diff.
	$1\frac{2}{12}$ Years (May 1874 July 1875).			12 Years.		
Jan. ...	21.°5	9.°6	11.°9	22.°1	8.°6	13.°5
Feb....	20. 7	9. 4	11. 3	22. 8	9. 0	13. 8
Mar....	24. 8	10. 6	14. 2	25. 2	10. 3	14. 9
April	25. 6	9. 4	16. 2	28. 3	15. 9	12. 4
May ...	29. 7	16. 3	13. 4	30. 7	20. 6	10. 1
June...	33. 0	21. 4	11. 6	31. 7	23. 4	8. 3
July ...	34. 2	24. 4	9. 8	32. 2	24. 8	7. 4
Aug....	32. 3	25. 1	7. 2	31. 8	24. 4	7. 4
Sept.	32. 3	23. 7	8. 6	31. 6	22. 2	9. 4
Oct. ...	29. 8	17. 9	11. 9	29. 3	18. 9	10. 4
Nov. ...	24. 2	12. 2	12. 0	27. 1	15. 7	11. 4
Dec. ...	23. 9	10. 2	13. 7	23. 3	9. 1	14. 2
Year...	34. 2	9. 4	24. 8	33. 1	6. 7	26. 4

56 VICTORIA PEAK. 57 MACAO.

	Max.	Min.	Diff.	Min.	Max.	Diff.
	$2\frac{1}{3}$ Years (1870-1872.)			$3\frac{6}{12}$ Years (1827—1830).		
Jan. ...	20.°5	5.°0	15.°5	24.°3	7.°7	16.°6
Feb....	19. 2	4. 0	15. 2	20. 2	7. 7	12. 5
Mar....	20. 6	7. 1	13. 5	23. 4	11. 3	12. 1
April	25. 0	13. 1	11. 9	27. 0	17. 4	9. 6
May ...	25. 6	18. 6	7. 0	30. 2	21. 1	9. 1
June...	26. 8	21. 6	5. 2	31. 2	23. 9	7. 3
July ...	26. 9	21. 5	5. 4	31. 5	25. 8	5. 7
Aug....	27. 1	21. 7	5. 4	32. 1	25. 4	6. 7
Sept.	27. 3	19. 4	7. 9	31. 9	24. 0	7. 9
Oct. ...	25. 3	16. 5	8. 8	28. 9	19. 8	9. 1
Nov. ...	22. 8	8. 9	13. 9	24. 2	13. 9	10. 3
Dec. ...	18. 8	4. 8	14. 0	21. 2	9. 7	11. 5
Year...	27. 5	2. 3	25. 2	32. 3	7. 4	24. 9

	58 ST. ANNA (near Manila).			59 PETERSBURG.		
	MAX.	MIN.	DIFF.	MAX.	MIN.	DIFF.
	4 Years.			3 Years (1872—1874).		
Jan. ...	30.°5	17.°5	13.°0	2.°6	—18.°1	20.°7
Feb. ...	31. 5	17. 1	14. 4	1. 3	—25. 1	26. 4
Mar. ...	32. 9	17. 4	15. 5	5. 3	—19. 8	25. 1
Apr. ...	35. 0	18. 7	16. 3	11. 7	—9. 1	20. 8
May ...	34. 9	20. 6	14. 3	22. 6	—0. 5	23. 1
June ...	34. 4	22. 2	12. 2	25. 1	7. 4	17. 7
July ...	33. 2	21. 4	11. 8	26. 6	10. 4	16. 2
Aug. ...	33. 7	21. 5	12. 2	26. 4	8. 7	17. 7
Sept ...	31. 2	22. 0	9. 2	19. 9	2. 9	17. 0
Oct. ...	30. 7	19. 5	11. 2	17. 0	—0. 5	17. 5
Nov. ...	30. 4	16. 1	14. 3	9. 8	—13. 3	23. 1
Dec. ...	30. 2	15. 4	14. 8	3. 6	—20. 1	23. 7
Year ...	35. 0	15. 4	19. 6	26. 9	—26. 9	53. 8

	60 JEKATERINBURG.			61 BARNAUL.		
	MAX.	MIN.	DIFF.	MAX.	MIN.	DIFF.
	3 Years (1872—1874).			3 Years (1872—1874).		
Jan. ...	—2.°8	—36.°7	33.°9	—5.°0	—40.°9	35.°9
Feb. ...	—1. 9	—29. 9	28. 0	—2. 6	—35. 7	33. 1
Mar. ...	2. 7	—27. 4	30. 1	6. 3	—28. 4	34. 7
Apr. ...	15. 3	—17. 1	32. 4	15. 3	—22. 2	37. 5
May ...	26. 4	—0. 2	26. 6	28. 1	1. 0	27. 1
June ...	26. 9	3. 9	23. 0	31. 1	5. 2	25. 9
July ...	30. 3	6. 6	23. 7	31. 4	12. 7	18. 7
Aug. ...	28. 3	7. 4	20. 9	29. 3	8. 3	21. 0
Sept. ...	21. 9	—1. 6	23. 5	25. 8	—2. 3	28. 1
Oct. ...	16. 5	—15. 6	32. 1	18. 8	—16. 2	35. 0
Nov. ...	5. 6	—22. 5	28. 1	8. 4	—26. 2	34. 6
Dec. ...	1. 3	—33. 2	34. 5	3. 0	—36. 2	39. 2
Year ...	30. 7	—37. 3	68. 0	32. 4	—44. 6	77. 0

DIFFERENCES BETWEEN THE ABSOLUTE

CONTINENT OF

62	Jan.	Feb.	Mar.	Apr.	May.	June.
Yakutsk	...	...	...	...	...	...
Udskoi	...	...	...	...	...	...
Nikolajevsk	26.°4	28.°0	31.°3	27.°6	19.°2	20.°2
Urga	30. 0	28. 4	39. 2	35. 1	36. 5	29. 8
Nerchinsk	27. 1	28. 2	33. 5	27. 8	27. 0	24. 7
Vladivostok	29. 4	24. 3	24. 6	23. 4	18. 1	21. 9
Si-wan-tse	32. 0	31. 1	30. 2	30. 1	28. 1	24. 3
New-chwang	24. 9	24. 4	25. 0	26. 1	20. 8	16. 7
Peking	20. 4	23. 8	26. 1	27. 5	25. 4	20. 9
Tientsin	17. 4	17. 5	15. 0	18. 8	16. 9	13. 1
Taku	15. 5	20. 7	22. 2	24. 9	22. 2	19. 3
Shanghai	17. 2	16. 2	...	29. 0	25. 4	17. 1
Fu-cheu-fu	...	...	...	18. 9	17. 2	15. 6
Canton	20. 3	15. 3	17. 7	11. 7	13. 6	9. 3
Bangkok	...	...	...	...	...	...

THE ISLANDS OF

63	Jan.	Feb.	Mar.	Apr.	May.	June.
Dui	15.°6	19.°4	19.°3	17.°5	20.°6	13.°5
Hakodate	26. 4	22. 8	26. 2	23. 6	22. 3	19. 8
Niegata	18. 0	14. 0	25. 0	19. 0	19. 0	20. 0
Yedo	17. 4	18. 4	24. 7	21. 3	21. 7	15. 8
Yokohama	18. 0	16. 2	18. 9	17. 1	16. 1	14. 3
Decima	17. 4	16. 9	16. 8	17. 7	14. 1	11. 6
Kelung	11. 9	11. 3	14. 2	16. 2	13. 4	11. 6
Victoria	13. 5	13. 8	14. 9	12. 4	10. 1	8. 3
Victoria Peak	15. 5	15. 2	13. 5	11. 9	7. 0	5. 2
Macao	16. 6	12. 5	12. 1	9. 6	9. 1	7. 3
St. Anna	13. 0	14. 4	15. 5	16. 3	14. 3	12. 2

MAXIMA AND MINIMA OF THE TEMPERATURE.

EASTERN ASIA.

July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
...	...	...	...	...	...	84.°2
...	...	...	...	...	...	78. 3
18.°6	19.°2	21.°6	27.°1	27.°5	30.°6	67. 9
23. 3	23. 2	27. 7	34. 2	38. 6	32. 9	74. 2
18. 7	19. 7	28. 2	31. 5	34. 0	33. 8	75. 6
20. 3	15. 3	18. 7	22. 5	26. 2	29. 3	61. 1
17. 4	20. 8	24. 4	32. 7	31. 1	34. 5	63. 9
13. 1	16. 4	19. 1	22. 2	23. 8	26. 1	55. 5
16. 7	16. 3	20. 5	23. 8	23. 2	21. 1	51. 6
11. 9	13. 1	13. 5	20. 6	22. 8	22. 6	44. 6
13. 8	16. 9	18. 0	21. 1	20. 3	17. 9	49. 9
17. 2	19. 6	19. 5	21. 5	24. 9	26. 2	47. 1
11. 8	13. 6	14. 4	18. 9	21. 1	23. 5	35. 0
10. 6	8. 7	11. 7	13. 9	14. 6	16. 4	33. 3
...	...	...	...	...	...	24. 2

EASTERN ASIA.

July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
13.°4	11.°3	11.°3	19.°3	21.°3	24.°1	49.°1
18. 0	16. 7	19. 7	21. 7	21. 7	24. 4	45. 6
17. 0	15. 0	18. 0	18. 0	15. 0	13. 0	45. 0
14. 7	14. 4	15. 0	17. 9	20. 7	21. 7	39. 2
12. 9	11. 0	14. 3	15. 0	18. 8	18. 5	35. 8
11. 4	9. 2	12. 7	16. 9	18. 4	16. 5	34. 0
9. 8	7. 2	8. 6	11. 9	12. 0	13. 7	24. 8
7. 4	7. 4	9. 4	10. 4	11. 4	14. 2	26. 4
5. 4	5. 4	7. 9	8. 8	13. 9	14. 0	25. 2
5. 7	6. 7	7. 9	9. 1	10. 3	11. 5	24. 9
11. 8	12. 2	9. 2	11. 2	14. 3	14. 8	19. 6

THE HIGHEST AND LOWEST TEMPERATURE,

Occurring during the course of the Year,

According to Tables (36)—(61), are as follows:—

CONTINENT OF EASTERN ASIA.

64	Max.	Min.	Amplitude.
Yakutsk	32.°1	—52.°1	84.°2
Udskoi	37. 1	—41. 2	78. 3
Nikolajevsk	28. 2	—39. 7	67. 9
Urga	34. 0	—40. 2	74. 2
Nerchinsk	30. 9	—44. 7	75. 6
Vladivostok	32. 3	—28. 8	61. 1
Si-wan-tse	32. 8	—31. 1	63. 9
Newchwang	32. 8	—22. 7	55. 5
Peking	36. 3	—15. 3	51. 6
Tientsin	34. 4	—10. 2	44. 6
Taku	37. 2	—12. 7	49. 9
Shanghai	38. 9	—8. 2	47. 1
Fu-cheu-foo	36. 1	1. 1	35. 0
Canton	33. 9	0. 6	33. 3
Bangkok	36. 2	12. 0	24. 2

THE ISLAND OF EASTERN ASIA.

65	Max.	Min.	Amplitude.
Dui	22.°5	—26.°6	49.°1
Hakodate	28. 9	—16. 7	45. 6
Niigata	36. 0	—9. 0	45. 0
Yedo	33. 0	—6. 2	39. 2
Yokohama	31. 4	—4. 4	35. 8
Decima	31. 6	—2. 4	34. 0
Keelung	34. 2	9. 4	24. 8
Victoria	33. 1	6. 7	26. 4
Victoria Peak	27. 5	2. 3	25. 2
Macao	32. 3	7. 4	24. 9
St. Anna near Manila	35. 0	15. 4	19. 6

The annual Maxima of temperature in summer are for all our places in (64 and 65) nearly the same, but the annual Minimum of the winter varies very much with the latitude. As I shall state in the next chapters, Eastern Asia must be, in regard to the climate during the cold seasons divided in three parts, differing very much one from another. To one part, which I will name "Amoor-Territory" belong the places Yakutsk, Okhotsk......New-chwang Dui, Kussunai and Aniwa [See the table (3)], extending from the latitude 60° to 40° and having a very severe winter.

To the second part, to which I will give the name "China," belongs China between the parallels 40° and 20°, having a much milder winter than the "Amoor-Territory." To the third part belong Japan and the southern islands of Eastern Asia. The limits of the "Amoor-Territory" on the southern and eastern side, in the direction of China, Corea and the sea, illustrate most evidently our chart of isothermal lines of January.

The limits of these climatic districts are located in those places, where the isothermal Lines (drawn at intervals of two degrees centigrade or 3.6 degrees Fahrenheit) are most closed; where therefore the temperature takes a leap, and increases very suddenly in the direction from N to S and NW to SE.

Within the "Amoor-Territory" the annual absolute Minimum of temperature varies between—22.°7 and—52.°1, within "China" between—15.°3 and 0.°4, and in Japan and southern islands of Eastern Asia between—16.°7 and 15.°4.

The "Amoor-Territory" therefore is subjected to a much severer winter than "China" and Japan, and the southern islands of Eastern Asia, or any other countries of the globe, comparing the same latitudes and heights over the sea.

The principal causes of the extraordinary coldness of the winter in Asia are its colossal dimensions and the absence of water basins in its interior, producing a clear atmosphere and extraordinarily great radiation of the warmth of the soil into the heavens.

North-America is not so extensive as Asia, and is covered with vast lakes, the temperature of the water of which varies more slowly, and which retain the summer warmth longer than the dry continent; therefore the winter of North-America is not so severe as that of Asia on the same latitude.

The coldest parts of both continents are their eastern sides, because the warm currents of the Atlantic and Pacific oceans—Gulfstream and Kuro-siwo—influencing the currents of the atmosphere (winds) and warming the western part of the European-Asiatic continent and of North-America, bring the centres of the winter anticyclones of Asia and North-America (*cf.* A. Buchan, The Mean Pressure of the Atmosphere and the Prevailing Winds over the globe, for the Months and for the Year; Trans. Roy. Soc. Edin. Vol. XXV.) and the middle of greatest coldness, to the East of the geometrical centres of the continents.

The coldness of the eastern coast of Asia and North-America is still further increasd in consequence of the cold water currents, running from N to S near the coast.

Though the cold water current of North-America, collecting on its eastern coast almost all the ice coming from the North-pole to S.

contains more ice and cooler water, than the cold current of Eastern Asia, which receives its cold water and ice almost wholly from the sea of Okhotsk, yet the coldness of the winter of Eastern North-America does not equal that of the winter of the more extended and drier Asia.

Comparing the two tables (64) and (65) we find, that on the islands of Eastern Asia, near the same latitudes, the winter is milder than on the opposite continent.

Hakodate on the latitude 42° has an annual Minimum about 12° higher than opposite places of the "Amoor-Territory;" and the absolute Minimum of the islands between Nipon and Macao is on an average 6° higher than the correspondent points of "China."

This contrast between the *islands* of Eastern Asia and the places of the *continent*—though located immediately on the sea, but not surrounded on all sides by water—is strikingly shown at Canton, a continental place, and Macao and Victoria (Hongkong), two islands.

Though Macao and Victoria, situated on the same latitude very near to the coast of the continent, are at a distance of only one hundred kilometers from Canton, located on the continent itself, yet the absolute annual Minimum of temperature is at Macao 7.°4, at Victoria 6.°7, but at Canton 0.°6 or very near the freezing point.

In accordance with this fact is a remark, made by Meyen in his little pamphlet "on the Climate of Southern China," namely: that at Canton there falls sometimes, in winter, snow, but at Macao and Victoria never.

On the continent of Eastern Asia therefore the absolute Minimum of temperature 0° extends to the tropic of Cancer; but on the islands of Eastern Asia the frost stops probably near the southern shores of Japan in latitude 30.°

The absolute Minima of the temperature on the same latitudes are much lower on eastern Asia than in Europe, according to the following table (66):

Lat.		East Asia. Absolute Min.	Europe. Absolute Min.		Lat.
62°	Yakutsk	—52.°1	—26.°9	St. Petersburg...	60°
54	Udskoi	—41. 2	—13. 0	Stralsund	54
53	Nikolajevsk	—39. 7	—11. 9	Brussels	51
42	Hakodate	—16. 7	—5. 0	Rome	42
40	Peking	—15. 3			
35	Yokohama	—4. 4			
31	Shanghai	—8. 2			

The differences between the temperatures of the absolute Maxima and Minima *i.e.* the absolute oscillation of the temperature within the different months and within the whole year—tables (64) and (65) are subjected to an annual period, comforming very nearly to the annual period of the mean daily amplitude of temperature. In the "Amoor-Territory" and Northern China exist two Maxima (in spring and autumn) and two Minima (in summer and in winter). The temperature there is the least variable during the summer and most variable during spring.

To the same law are subjected all the islands of Eastern Asia with few exceptions, for example Victoria Peak and Macao, where the temperature is most variable in winter and least variable in summer.

The quantity of the absolute monthly and annual changes of temperature—(62) and (63)—is much greater than the mean daily amplitude of temperature [*cf.* tables (22) and (23)] and decreases, during all the months from N to S: the differences are greatest in the "Amoor-Territory," varying between 11° and 39°; in "China" they are less, between 8° and 28°. On the islands are the smallest quantity, table (63), 5.°2 and the greatest 26.°4. Therefore the non-periodical monthly absolute variation of the temperature is greatest in the "Amoor-Territory," about 25° on an average, smaller in "China," about 18° on an average, and smallest on the islands, about 16° on an average.

The absolute variation of the temperature during the year—tables (62) and (63), year column—varies in the "Amoor-Territory" between 49.°1 and 87.°7, in China between 33.°3 and 51.°6 and on the islands between 19.°6 and 45.°6.

For comparison between Eastern Asia and Europe and Western Siberia I have procured the following numbers (67):

	Absolute Annual		Diff.	Number of Years Ob'ved.
	Max.	Min.		
Brussels	30.°1	—11.°9	42.°0	33
Stralsund	28. 9	—13. 0	41. 9	19
St. Pstersburg	26. 9	—26. 9	53. 8	3
Jekaterinenburg	30. 7	—37. 3	68. 0	3
Barnaul	32. 4	—44. 6	77. 0	3

The quantities Diff. of table (67), belonging to Western Europe, are much smaller than the correspondent values Diff. of tables (64) and (65) in the "Amoor-Territory" and little smaller than in Northern China [Peking].

The day of the first and last frost I have calculated only from 23 yearly observations at Peking; not having at hand observations, made at other places of Eastern Asia.

To this element of climatology for Peking I have added those of Nerchinsk, Barnaul and St. Petersburg, taken from the book "On the Climate of Russia by Wesselofsky." (68)

	Last Frost.	First Frost.	Difference No. of Days.	No. of Years Ob'ved.
Nerchinsk	May, 12	Sept., 3	114	10
Peking	Mar., 28	Nov., 1	217	23
Barnaul	May, 6	Sept., 4	121	12
St. Petersburg.........	April, 25	Sept., 24	152	14

ANNUAL PERIOD OF THE TEMPERATURE.

To the following materials, concerning the mean monthly temperature of the air—tables (69) to (134)—I have added the mean daily temperature at Peking, table (135), calculated from 23 years observations, made every day at 7 a.m., 1 p.m. and 9 p.m., and reduced to 24-hourly mean.

Peking is the only place in Eastern Asia, where we possess observations sufficiently prolonged to define exactly the daily mean temperature. It is probable, that the values of the table (135) come very near to the true daily means; because the mean monthly temperature at Peking, being itself very low considering its low latitude, changes, according to the table (136), very little from one year to another, in comparison with other places in Eastern Asia and Europe on the same latitude. For example, according to (136) and (138), the absolute (temporal) variability of the mean monthly (or annual) temperature (*i.e.* the differences between the highest and lowest monthly or annual mean, observed during a long series of years) in Italy is greater than at Peking. The absolute variability of the monthly mean of temperature in the "Amoor-Territory" is nearly the same as in western Siberia, a little smaller than in European Russia, and in winter greater than in Germany.

The absolute variability of the monthly mean temperature in North China is small, smaller than in Italy, having nearly the same latitude, and a little greater than in southern Japan. In all these mentioned countries the variability of the mean temperature from one year to another is smallest in summer and greatest in winter.

OKHOTSK.

Observations during the years 1843—1845, 7 *a.m.*, 2 *p.m.* & 8 *p.m. daily; and during the years* 1846—1852, 6 *a.m.*, 2 *p.m.* & 10 *p.m. daily.*

From the Sapiski "of the I. Russian Hydrographical Department, 24 hourly Means."

69	Jan.	Feb.	Mar.	Apr.	May.	June.	
1843	......	......	......	......	......	7.°7	
1844	—27.°9	—28.°1	—13.°2	—4.°2	3.°0	7. 8	
1845	—25. 4	—21. 8	—14. 2	—4. 8	2. 7	8. 4	
1846	—28. 9	—22. 7	—10. 0	—6. 0	1. 5	6. 4	
1847	—19. 9	—28. 4	—14. 4	—6. 9	3. 0	9. 7	
1848	—22. 7	—18. 2	—10. 1	—6. 1	3. 7	7. 9	
1849	—24. 2	—23. 0	—16. 1	—6. 4	2. 2	8. 1	
1850	—23. 8	—25. 2	—10. 6	—7. 8	0. 5	9. 1	
1851	—23. 4	—22. 5	—20. 0	—6. 9	4. 0	10. 3	
1852	—22. 7	—24. 4	—14. 8	—6. 9	0. 0	6. 8	
Mean	—24. 82	—22. 92	—13. 71	—6. 22	2. 27	8. 22	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1843	13.°6	14.°3	8.°3	—2.°8	—11.°9	—25.°7	......
1844	11. 9	12. 4	10. 5	—0. 4	—13. 1	—22. 8	—5.°34
1845	11. 4	12. 3	7. 8	—4. 7	—11. 7	—21. 5	—5. 12
1846	12. 7	14. 8	7. 0	—0. 6	—20. 5	—28. 6	—6. 24
1847	12. 6	13. 1	8. 5	—3. 9	—12. 1	—23. 6	—4. 53
1848	11. 4	11. 4	8. 8	—4. 1	—13. 8	—25. 0	—4. 73
1849	14. 2	14. 9	6. 7	—2. 9	—15. 9	—20. 5	—5. 24
1850	15. 3	14. 7	9. 6	—7. 1	—19. 3	—24. 7	—5. 77
1851	14. 7	......	......	......	—13. 7	—18. 5	......
1852	......	......	......	......	......	......	......
Mean	13. 09	13. 49	8. 40	—3. 31	—14. 67	—23. 43	—5. 26

NIKOLAJEVSK.

From my treatise "On the Climate of the Amoor-Territory" in "Reisen und Forschungen im Amurlande von h. v. Schrenck" T. IV pag. 333. 24 hourly Means.

70	Jan.	Feb.	Mar.	Apr.	May.	June.
1855	—13.°2	—20.°6	—12.°6	—0.°6	4.°9	13.°2
1856	—19. 2	—22. 0	—13. 9	—4. 1	2. 7	12. 6
1857	—24. 1	—19. 4	—16. 6	—3. 5	2. 4	12. 4
1858	—26. 0	—20. 0	—17. 2	0. 0	6. 7	13. 9
1859	—25. 9	—23. 9	—14. 4	—3. 6	3. 9	14. 2
1860	—27. 0	—21. 2	—17. 0	—4. 1	4. 9	10. 6
1861	—25. 9	—24. 5	—12. 9	—4. 1	4. 1	12. 2
1862	—19. 2	—22. 2	—10. 1	—3. 0	3. 0	12. 7
1863	—25. 2	—20. 2	—11. 9	—2. 1	4. 7	11. 4
1865	—20. 9	—21. 9	—15. 5	—2. 4	6. 2	12. 0
1866	—24. 4	—20. 1	—13. 1	—3. 0	4. 7	14. 5
1867	—28. 6	—23. 4	—14. 1	—8. 0	1. 5	8. 0
1868	—24. 1	—19. 6	—14. 6	—2. 9	3. 5	10. 2
1869	—25. 9	—18. 6	—15. 4	—5. 2	0. 6	12. 0
1871	—26. 1	—24. 1	—14. 6	—5. 5	1. 1	9. 2
1872	—25. 0	—19. 6	—13. 0	—3. 6	3. 4	16. 2
Mean	—24. 5	—21. 4	—14. 3	—3. 7	3. 6	12. 1

NIKOLAJEVSK,—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1855	16.°1	......	......	0.°0	—12.°4	—18.°5	......
1856	13. 2	16.°1	9.°6	3. 1	—10. 9	—21. 4	—2.°84
1857	16. 7	15. 4	9. 2	1. 2	—7. 2	—21. 7	—2. 94
1858	18. 0	14. 6	9. 0	2. 1	—6. 5	—19. 2	—2. 05
1859	14. 2	13. 6	7. 6	—1. 0	—9. 5	—13. 6	—3. 19
1860	18. 7	18. 5	10. 0	1. 0	—14. 4	—25. 5	—3. 80
1861	12. 9	12. 6	9. 9	0. 4	—9. 7	—19. 9	—3. 74
1862	15. 7	15. 1	12. 9	2. 7	—11. 5	—21. 6	—2. 12
1863	17. 2	15. 1	8. 4	0. 5	—10. 4	—15. 2	—2. 29
1865	15. 1	15. 7	10. 2	4. 7	—9. 1	—15. 1	—1. 72
1866	19. 5	15. 9	10. 9	1. 6	—8. 2	—19. 0	—1. 72
1867	14. 7	18. 0	10. 0	1. 4	—9. 0	—21. 4	—4. 24
1868	16. 5	16. 0	8. 6	1. 4	—13. 2	—23. 4	—3. 47
1869	16. 9	14. 5	10. 1	3. 2	—11. 6	—25. 5	—3. 74
1871	17. 9	15. 5	9. 6	1. 1	—8. 4	—21. 2	—3. 79
1872	16. 4	18. 6	12. 7	0. 7	—13. 2	—22. 6	—2. 41
Mean	16. 2	15. 7	9. 9	1. 6	—10. 2	—20. 4	—2. 94

URGA.

Observations made at the I. Russian Consulate at Urga, under the Superintendence of the Consul J. P. Schischmareff, Esq., by Mss. Dsodbojeff and Mossin.

Instruments and Instruction from the I. Russian Observatory at Peking.

Mean of the Four Years 1870, 1871, 1872 and 1874.

71	Jan.	Feb.	Mar.	Apr.	May.	June.	
7 a.m.,	—30.°8	—26.°3	—15.°5	—2.°1	5.°8	12.°4	
1 p.m.,	—22. 2	—16. 0	—5. 1	6. 7	14. 0	20. 0	
9 p.m.,	—29. 2	—23. 9	—13. 3	—1. 5	6. 0	12. 1	
Mean	—27. 4	—22. 1	—11. 3	1. 0	8. 6	14. 8	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
7 a.m.,	15.°3	11.°9	5.°4	—5.°5	—17.°3	—25.°6	—6.°02
1 p.m.,	23. 3	20. 6	16. 2	4. 5	—7. 9	—17. 3	3. 08
9 p.m.,	15. 6	12. 8	7. 0	—4. 2	—16. 0	—24. 1	—4. 87
Mean	18. 1	15. 1	9. 5	—1. 7	—13. 7	—22. 3	—2. 61

The 24 hourly mean monthly temperatures, calculated by the help of the hourly observations at Nerchinsk [table (4)] are:

72	Jan.	Feb.	Mar.	Apr.	May.	June.
1870	—28.°9	—25.°0	—13.°8	0.°3	8.°5	12.°5
1871	—27. 4	—22. 4	—8. 7	0. 2	5. 2	14. 3
1872	—30. 3	—22. 8	—12. 9	—0. 7	9. 2	14. 4
1874	—24. 5	—18. 1	—9. 8	3. 4	10. 0	15. 8
Mean	—27. 8	—22. 1	—11. 3	0. 8	8. 2	14. 2

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1870	17.°7	14.°9	9.°2	—2.°5	—17.°1	—25.°9	—4.°17
1871	19. 1	16. 2	9. 5	—0. 9	—14. 3	—22. 9	—2. 67
1872	16. 3	13. 4	8. 8	—3. 0	—12. 9	—21. 3	—3. 48
1874	17. 3	14. 8	10. 2	—0. 9	—11. 9	—20. 9	—1. 2
Mean	17. 6	14. 8	9. 4	—1. 8	—14. 0	—22. 7	—2. 88

VLADIVOSTOK.

Observations, made by E. Hansen, Esq., daily at 8 a.m., 1 p.m., 5 p.m. and 11 p.m.

(Cf. Zeitschrift |der Oesterreichischen Gesellschaft für Meteorologie J. X. No. 6.)

24 Hourly monthly means, calculated by the help of our above table (13.)

73	Jan.	Feb.	Mar.	Apr.	May.	June.
1872	—18.°0	—11.°6	—2.°6	3.°6	8.°8	13.°8
1873	—17. 4	—12. 7	—5. 7	2. 2	7. 9	12. 6
1874	—12. 6	—8. 8	—3. 1	4. 8	8. 8	14. 4
Mean	—16. 0	—11. 0	—3. 8	3. 5	8. 5	13. 6

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872	18.°1	18.°5	15.°4	9.°6	—0.°1	—10.°4	3.°7
1873	18. 0	19. 9	14. 0	7. 6	—2. 1	—11. 2	2. 7
1874	20. 1	21. 0	15. 9	8. 2	—2. 2	—9. 8	4. 7
Mean	18. 7	19. 8	15. 1	8. 5	—1. 5	—10. 5	3. 7

SI-WAN-TSE.

Observations, made at the Mission at Si-wan-tse, under the Superintendence of the Rev.—Van Aertseiaer, by the Chinese elèves of the Seminary of the Belgian Ecclesiastical Mission. Instruments and instructions by the I. Russian Observatory at Peking.

74	7 a.m.	1 p.m.	8 p.m.	Mean.
Jan. 1874	—22.°2	—10.°0	—17.°7	—16.°6
,, 75	—21. 1	— 9. 0	—17. 4	—15. 8
Feb. 1874	—17. 0	— 1. 6	—10. 5	— 9. 7
,, 75	—17. 5	— 5. 7	—14. 0	—12. 4
Mar. 1874	—10. 8	3. 6	— 5. 3	— 4. 2
,, 75	— 3. 7	4. 1	— 2. 5	— 0. 7
Apr. 1874	1. 6	8. 8	3. 3	4. 6
,, 75	— 0. 5	8. 0	2. 0	3. 2
May 1874	7. 1	14. 3	8. 6	10. 0
,, 75	10. 0	21. 0	12. 7	14. 6
June 1874	14. 0	22. 8	17. 8	18. 2
,, 75	14. 2	23. 3	16. 9	18. 1
July 1874	16. 3	23. 6	17. 6	19. 2
,, 75	16. 0	23. 0	18. 0	19. 0
Aug. 1874	13. 3	22. 1	17. 2	17. 5
,, 75	18. 2	24. 7	18. 5	20. 5
Sept. 1874	7. 3	18. 0	10. 8	12. 0
,, 73	9. 5	16. 6	11. 3	12. 5
Oct. 1874	1. 4	9. 0	2. 1	4. 2
,, 73	1. 8	8. 5	2. 3	4. 2
Nov. 1874	—12. 0	— 2. 5	— 7. 7	— 7. 4
,, 73	—10. 5	1. 0	— 6. 5	— 5. 3
Dec. 1874	—15. 2	— 6. 1	—13. 6	—11. 6
,, 73	—15. 1	— 2. 7	—10. 6	— 9. 5

Therefore the means of the two years, September 1873—August 1875:

75	Jan.	Feb.	Mar.	Apr.	May.	June.
7 a.m....	—21.°6	—17.°2	— 7.°2	0.°5	8.°5	14.°1
1 p.m....	— 9. 5	— 3. 7	3. 9	8. 4	17. 6	23. 0
8 p.m....	—17. 5	—12. 2	— 3. 9	2. 7	10. 7	17. 4
Mean ...	—16. 2	—11. 0	— 2. 4	3. 9	12. 3	18. 2

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
7 a.m....	16.°2	15.°7	8.°4	1.°6	—11.°2	—15.°1	—0.°61
1 p.m....	23. 3	23. 4	17. 3	8. 8	— 0. 7	— 4. 4	8. 95
8 p.m....	17. 8	17. 8	11. 0	2. 2	— 7. 1	—12. 1	2. 24
Mean ...	19. 1	19. 0	12. 2	4. 2	— 6. 3	—10. 5	3. 54

Let S. denote the Temperature at Si-wan-tse at any time of the day, and P. the Temperature at Peking at the same moment of the day, the connection between S. and P. will be expressed by the following equations:

76			
	Winter..................	S.= — 7.°8	+ 1.83 P.
	Springtime	S.= —13. 2	+ 1.34 P.
	Summer	S.= —16. 1	+ 1.37 P.
	Autumn	S.= —12. 6	+ 1.29 P.

According to these equations we have the following reductions of the means of the hours—7 a.m., 1 p.m. and 8 p.m. to 24 hourly means:

77	Winter.	Springtime.	Summer.	Autumn.
	—0.°3	—0.°5	—0.°7	—0.°3

and combining table (77) with table (75) the 24 hourly monthly means at Si-wan-tse:

78 Jan.	Feb.	Mar.	Apr.	May.	June.	
—16.°5	—11.°3	— 2.°8	3.°4	11.°7	17.°6	
July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
18.°4	18.°4	11.°7	3.°9	—6.°6	—10.°8	3.°09

And last, adding to (78) minor corrections, derived from the 23 yearly observations at Peking, table (85), the 24 hourly means of the temperature at Si-wan-tse, reduced from two yearly observations to mean yearly, *i.e.* eliminated from temporary disturbances, will be:

79 Jan.	Feb.	Mar.	Apr.	May.	June.	
—16.°7	—11.°7	— 3.°0	3.°2	11.°9	16.°9	
July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
19.°5	17.°0	11.°4	3.°9	—6.°9	—11.°7	2.°82

KALGAN.

Observations made by K. T. Gromoff, Esq., 7 a.m., 1 p.m. and 9h. p.m. daily. Instruments and Instructions from the I. Russian Observatory at Peking.

The monthly means, reduced to 24 hourly and many yearly means by help of the Peking observations, are:

80	Jan.	Feb.	Mar.	Apr.	May.	June.
1871......	...	...	...	...	...	...
1872......	—11.°1	—8.°4	...	...	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1871......	...	23.°0	17.°6	7.°9	—1.°9	—8.°7
1872......	...	...	...	...	...	...

and the annual mean Temperature, calculated by combination of table (80) with (84), will be :—

81	From January	9.°3
	„ February	7. 5
	„ August	7. 3
	„ September	7. 5
	„ October	6. 0
	„ November	3. 4
	„ December	6. 7
	Mean	6. 8

NEW-CHWANG.

Observations, made at the Ch. I. M. Custom-House, communicated by E. C. Taintor, Esq.

MONTHLY MEAN TEMPERATURE.

82 1872	Jan.	Feb.	Mar.	Apr.	May.	June.
4 a.m.	—17.°8	—13.°5	—5.°1	4.°9	11.°9	18.°1
9 a.m.	—14. 1	— 8. 3	—1. 2	9. 2	16. 6	23. 2
Noon	—10. 2	— 3. 8	3. 6	11. 6	18. 7	25. 0
3 p.m.	—10. 8	— 3. 6	3. 9	12. 2	19. 0	25. 5
8 p.m.	—14. 4	—10. 2	—0. 5	7. 4	14. 6	20. 6
Mean	—13. 5	— 7. 9	0. 1	9. 1	16. 2	22. 5

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
4 a.m.	22.°6	20.°5	16.°3	7.°1	—0.°1	—7.°5
9 a.m.	26. 9	25. 1	20. 4	11. 8	2. 0	—5. 6
Noon	28. 8	27. 0	23. 0	14. 3	4. 2	—2. 8
3 p.m.	28. 8	27. 3	23. 3	14. 3	4. 2	—2. 7
8 p.m.	24. 4	23. 5	18. 6	10. 8	2. 8	—4. 8
Mean	26. 3	24. 7	20. 3	11. 7	2. 6	—4. 7

The numbers of table (83) for 1872 are the sums of the means of the hours—4 a.m., 9 a.m., noon, 3 p.m. and 8 p.m. [table (82)], and the corrections, contained in table (10).

The observations for October 1861—November 1862 are made by T. T. Meadows, Esq., near sunrise and at 3 o'clock in the afternoon every day, and published in Zeitschrift der Oesterreichischen Gesellschaft fur Meteorologie J. VII. page 7. The 24 hourly means I have calculated by help of table (9).

24 hourly monthly means of the Temperature at Newchwang:

83	Jan.	Feb.	Mar.	Apr.	May.	June.
1862...	— 9.°7	—6.°4	0.°6	9.°0	16.°1	22.°5
1872...	—14. 1	—8. 7	—0. 8	8. 2	15. 4	21. 6
Mean..	—12. 0	—7. 5	—0. 1	8. 6	15. 7	22. 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1862...	25.°1	24.°2	17.°7	10.°0	4.°5	—8.°4	8.°75
1872...	25. 7	24. 0	19. 4	10. 6	1. 8	—5. 5	8. 12
Mean..	25. 4	24. 1	18. 5	10. 3	3. 1	—7. 0	8. 43

Hence follows the Monthly Range of the Temperature:

84 Jan.	Feb.	Mar.	Apr.	May.	June.
+ 20.°4	+ 15.°9	+ 8.°5	—0.°2	—7.°3	—13.°6
July.	Aug.	Sept.	Oct.	Nov.	Dec.
—17.°0	—15.°7	—10.°1	—1.°9	+ 5.°3	+ 15.°4

PEKING.

MEAN MONTHLY TEMPERATURE.

(Cf. my treatise "Ueber das Climat Pekings," page 25.)

85	Jan.	Feb.	Mar.	Apr.	May.	June.
1841...	—6.°4	—2.°9	2.°5	13.°5	19.°8	21.°5
1842...	—4. 1	—1. 6	6. 7	15. 3	19. 8	23. 8
1843...	—3. 7	1. 2	5. 3	15. 2	19. 0	22. 7
1844...	—3. 4	0. 3	7. 1	13. 4	19. 0	23. 1
1845...	—2. 9	—0. 9	6. 4	14. 1	21. 7	26. 2
1846...	—4. 0	1. 2	6. 0	13. 4	18. 2	24. 9
1847...	—2. 3	—0. 9	5. 1	16. 0	20. 3	23. 5
1848...	—6. 1	—0. 1	6. 2	13. 9	21. 2	23. 9
1849...	—2. 3	2. 0	7. 0	11. 9	18. 7	24. 4
1850...	—4. 1	—1. 0	6. 9	10. 9	20. 2	22. 9
1851...	—3. 4	—1. 2	2. 2	11. 8	18. 8	25. 9
1852...	—5. 0	—5. 4	2. 8	12. 9	19. 9	24. 8
1853...	—5. 0	—3. 3	4. 5	12. 0	19. 4	24. 8
1854...	—4. 3	—6. 2	6. 0	14. 4	21. 7	24. 7
1855...	—5. 1	—1. 3	5. 7	16. 9	20. 7	24. 5
1860...	—5. 9	—1. 9	1. 3	18. 3	17. 5	24. 3
1861...	—8. 1	—4. 4	5. 5	15. 3	18. 2	25. 7
1869...	—3. 1	—0. 9	4. 6	12. 5	21. 7	24. 6
1870...	—5. 0	—1. 9	5. 2	12. 8	21. 2	24. 3
1871...	—5. 0	—2. 6	6. 6	13. 7	20. 4	24. 7
1872...	—6. 2	—2. 0	4. 1	12. 7	20. 1	24. 0
1873...	—5. 5	—0. 8	4. 0	15. 1	21. 0	24. 9
1874...	—4. 5	0. 1	4. 7	16. 0	18. 2	24. 7
Mean..	—4. 58	—1. 42	5. 06	13. 78	19. 86	24. 30

PEKING.—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1841...	25.°2	23.°5	18.°7	11.°7	3.°7	—3.°9	10.°41
1842...	24. 0	23. 8	19. 9	11. 6	3. 6	—0. 5	11. 86
1843...	25. 0	24. 8	19. 9	10. 8	3. 8	—0. 3	11. 97
1844...	24. 8	25. 4	19. 6	13. 7	6. 8	—2. 9	12. 08
1845...	25. 7	23. 8	19. 9	12. 3	4. 6	—6. 3	12. 05
1846...	27. 0	25. 7	21. 4	13. 1	3. 5	—0. 5	12. 57
1847...	27. 4	24. 7	20. 1	12. 6	7. 2	—2. 0	12. 71
1848...	26. 9	24. 1	20. 0	12. 6	4. 3	0. 4	12. 27
1849...	24. 8	25. 4	20. 3	11. 5	4. 4	—2. 4	12. 16
1850...	25. 5	23. 2	19. 9	12. 4	0. 8	—3. 1	11. 21
1851...	25. 9	23. 9	18. 6	11. 5	2. 3	—3. 6	11. 06
1852...	26. 8	24. 0	19. 2	14. 0	3. 1	—1. 9	11. 27
1853...	27. 8	25. 5	21. 5	10. 7	4. 0	—3. 2	11. 56
1854...	28. 0	25. 1	20. 4	12. 9	5. 2	—2. 5	12. 12
1855...	26. 5	24. 5	20. 0	12. 9	3. 7	—0. 5	12. 37
1860...	24. 7	25. 2	22. 4	11. 2	1. 5	—3. 5	10. 84
1861...	27. 3	24. 8	18. 5	12. 9	4. 6	—4. 6	11. 31
1869...	26. 9	25. 4	20. 3	14. 5	3. 8	—3. 1	12. 42
1870...	26. 1	24. 8	21. 1	13. 4	2. 9	—3. 5	11. 78
1871...	26. 0	24. 6	19. 1	13. 7	2. 8	—3. 6	11. 70
1872...	26. 7	24. 5	20. 0	12. 6	3. 2	—1. 3	11. 53
1873...	25. 8	23. 5	20. 1	12. 5	4. 8	—0. 8	12. 05
1874...	25. 0	25. 3	20. 7	12. 4	3. 4	—2. 2	11. 98
Mean..	26. 08	24. 59	20. 07	12. 50	3. 82	—2. 38	11. 81

TIENTSIN.

Observations made under the superintendence of A. D. Startseff, Esq., by J. W. Bartascheff, Esq.; daily at 8a.m., 1 p.m. and 9 p.m.

Instruments and instructions from the I. Russian observatory at Peking.

Monthly means, reduced to 24 hourly means by the help of table (3).

86.	Jan.	Feb.	Mar.	Apr.	May.	June.	
1872 ...	—3.°9	—0.°4	5.°0	12.°2	19.°4	23.°9	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872 ...	27.°7	25.°6	22.°1	14.°7	4.°1	1.°0	12°6

TIENTSIN,—*Continued.*

Since at Peking the deviations of the year 1872 from the mean of 23 years observations, are:

Jan.	Feb.	Mar.	Apr.	May.	June.	
+1.°6	+0.°6	+1.°0	+1.°1	—0.°2	+0.°3	
July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
—0.°6	+0.°1	+0.°1	+0.°1	+0.°6	—1.°1	+0.°3

The true monthly means, reduced to 24 hourly and many-yearly observations at Tientsin, will be:

Jan.	Feb.	Mar.	Apr.	May.	June.	87
—2.°3	0.°2	6.°0	13.°3	19.°2	24.°2	
July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
27.°1	25.°7	22.°2	14.°6	4.°7	—0.°1	12.°9

TAKU.

Observations made at the Ch. I. M. Custom House by Messrs. Hancock, Morehead and Trannack.

Instruments and instruction from the I. Russian Observatory at Peking.

MEAN TEMPERATURES.

88 1873.	7 a.m.	1 p.m.	9. p.m.	Mean.
January	—6.°0	—3.°4	—5.°5	—5.°0
February	—5. 0	2. 1	—2. 7	—1. 9
March	0. 2	7. 0	2. 7	3. 3
April	10. 7	16. 7	12. 0	13. 1
May	18. 7	23. 9	18. 6	20. 4
June	23. 6	27. 7	21. 9	24. 4
July	26. 2	28. 7	25. 2	26. 8
August	24. 2	28. 1	24. 4	25. 6
September	18. 9	23. 6	19. 9	20. 8
October	10. 9	15. 6	12. 0	12. 8
November	1. 7	8. 7	4. 0	4. 8
December	—3. 2	2. 4	—1. 6	—0. 8
Mean	10. 1	15. 1	10. 9	12. 0

89 1874.	7 a.m.	1 p.m.	9 p.m.	Mean.
January	—8.°4	—1.°1	—5.°7	—5.°1
February	—4. 9	3. 1	—1. 5	—1. 1
March	0. 2	8. 2	3. 6	4. 0
April	11. 4	17. 9	12. 2	13. 8
May	16. 9	20. 5	16. 7	18. 0
June	23. 1	27. 5	22. 5	24. 4

TAKU,—*Continued.*

MEAN TEMPERATURE.

1874.	7 a.m.	1 p.m.	9 p.m.	Mean.
July	24.°9	28.°5	24.°4	25.°9
August	24. 7	28. 5	25. 2	26. 1
September	18. 1	25. 0	20. 6	21. 2
October	9. 6	16. 0	11. 9	12. 5
November	—0. 5	7. 1	2. 6	3. 1
December	—3. 7	1. 1	—2. 0	—1. 5
Mean	9. 3	15. 2	10. 9	11. 8

90 1875.	7 a.m.	1 p.m.	9 p.m.	Mean.
January	—8.°2	—0.°2	—4.°9	—4.°4
February	—6. 1	0. 9	—2. 9	—2. 7
March	2. 7	8. 6	4. 7	5. 3
April	8. 4	14. 5	9. 9	10. 9
May	18. 4	23. 0	18. 0	19. 8
June	25. 7	27. 4	23. 1	25. 4
July	26. 4	28. 2	25. 6	26. 7
August	28. 2	30. 9	27. 0	28. 7
September	17. 9	23. 0	20. 0	20. 3
October	9. 2	15. 7	12. 4	12. 4
November	1. 0	7. 0	4. 0	4. 0
December	—5. 9	—2. 0	—3. 2	—3. 7
Mean	9. 8	14. 7	11. 1	11. 9

Therefore the means of the three years 1873—1875, will be:

91	Jan.	Feb.	Mar.	Apr.	May.	June.	
7 a.m....	—7.°5	—5.°3	1.°0	10.°2	18.°0	24.°1	
1 p.m....	—1. 6	2. 0	7. 9	16. 4	22. 5	27. 5	
9 p.m....	—5. 4	—2. 4	3. 7	11. 4	17. 8	22. 5	
Mean ...	—4. 8	—1. 9	4. 2	12. 7	19. 4	24. 7	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
7 a.m....	25.°8	25.°7	18.°3	9.°9	0.°7	—4.°3	9.°7
1 p.m....	28. 5	29. 2	23. 9	15. 8	7. 6	0. 5	15. 0
9 p.m....	25. 1	25. 5	20. 2	12. 1	3. 5	—2. 3	11. 0
Mean ...	26. 5	26. 8	20. 8	12. 6	3. 9	—2. 0	11. 9

Further follows from (88), (89) and (90) and the table (3), that the 24 hourly monthly means of the temperature at Taku are:

92	Jan.	Feb.	Mar.	Apr.	May.	June.
1873...	—5.°0	—1.°9	3.°3	12.°9	20.°1	24.°0
1874...	—5. 1	—1. 1	4. 0	13. 6	17. 7	24. 0
1875...	—4. 4	—2. 7	5. 3	10. 7	19. 5	25. 0
Mean..	—4. 8	—1. 9	4. 2	12. 4	19. 1	24. 3

TAKU.—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1873...	26.°5	25.°4	20.°6	12.°7	4.°7	—0.°9	11.°8
1874...	25. 6	25. 9	21. 0	12. 4	3. 0	—1. 6	11. 6
1875...	26. 4	28. 5	20. 1	12. 3	3. 9	—3. 8	11. 7
Mean..	26. 2	26. 6	20. 6	12. 5	3. 9	—2. 1	11. 75

At Peking have been observed the following monthly 24 hourly means:

93	Jan.	Feb.	Mar.	Apr.	May.	June.	
1873...	—5.°5	—0.°8	4.°0	15.°1	21.°0	24.°9	
1874...	—4. 5	0. 1	4. 7	16. 0	18. 2	24. 7	
1875...	—4. 3	—2. 2	6. 0	11. 9	21. 3	25. 3	
Mean..	—4. 8	—1. 0	4. 9	14. 3	20. 2	25. 0	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1873...	25.°8	23.°5	20.°1	12.°5	4.°8	—0.°8	12.°05
1874...	25. 0	25. 3	20. 7	12. 4	3. 4	—2. 2	11. 98
1875...	24. 9	26. 8	18. 9	11. 7	2. 7	—3. 1	11. 66
Mean..	25. 2	25. 2	19. 9	12. 2	3. 6	—2. 0	11. 90

Comparing (93) with table (85), we assume for elimination of the temporal disturbances, contained in (92), the reductions:

94	Jan.	Feb.	Mar.	Apr.	May.	June.	
	+ 0.°2	—0.°4	+ 0.°2	—0.°5	—0.°3	—0.°7	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	+ 0.°9	—0.°6	+ 0.°2	+ 0.°3	+ 0.°2	—0.°4	—0.°1

and finally the true monthly means of the Temperature, reduced to many-yearly and 24 hourly observations at Taku:

95	Jan.	Feb.	Mar.	Apr.	May.	June.	
	—4.°6	—2.°3	4.°4	11.°9	18.°8	23.°6	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	27.°1	26.°0	20.°8	12.°8	4.°1	—2.°5	11.°7

CHEFOO.

Observations made in the I. M. Custom-House, daily at 10 a.m., 4 p.m. and midnight, and daily Maximum and Minimum.

Means of 10 a.m., 4 p.m., midnight, Maximum and Minimum, reduced to 24 hourly means by the help of the hourly observations at Peking and at Shanghai:

96	Jan.	Feb.	Mar.	Apr.	May.	June.
1871...........	—2.°2	...	...	...	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
1871...........	26.°8	25.°7	22.°2	17.°0	6.°1	1.°7

The reductions of this observations to respectively 23 yearly and 12 yearly means by the help of the observations, made at Peking, (85), and Shanghai, (102), are:

97	Jan.	Feb.	Mar.	Apr.	May.	June.
Peking.........	+1.°6	...	...	...	...	...
Shanghai......	+0. 2	...	...	...	...	...
Mean	+0. 9	...	...	...	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Peking.........	+0.°1	0.°0	+1.°0	—1.°2	+1.°0	+1.°2
Shanghai......	—0. 9	—1. 5	—2. 8	—1. 8	—0. 5	+2. 7
Mean	—0. 4	—0. 7	—0. 9	—1. 5	+0. 2	+2. 0

Adding (96) to (97), we will have the corrected 24 hourly, many-yearly means:

98 Jan.	Feb.	Mar.	Apr.	May.	June.
—1.°3	...	...	...	...	...
July.	Aug.	Sept.	Oct.	Nov.	Dec.
26.°4	25.°0	21.°3	15.°5	6.°3	3.°7

In order to calculate the mean annual temperature at the Chefoo by means of table (98), I take the mean of the two series (85) and (105):

99	Jan.	Feb.	Mar.	Apr.	May.	June.	
	—0.°6	1.°5	6.°7	13.°4	19.°2	23.°5	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	27.°1	25.°8	21.°5	14.°9	7.°2	1.°7	13.°5

Therefore, the Monthly Range will be:

100 Jan.	Feb.	Mar.	Apr.	May.	June.
+14.°1	+12.°0	+6.°8	+0.°1	—5.°7	—10.°0
July.	Aug.	Sept.	Oct.	Nov.	Dec.
—13.°6	—12.°3	—8.°0	—1.°4	+6.°3	+11.°8

By addition of (100) and (98), we receive the following quantities for the annual mean temperature at Chefoo:

101		
	January.......	12.°8
	July	12. 8
	August	12. 7
	September..................................	13. 3
	October	14. 1
	November..................................	12. 6
	December	15. 5
	Mean	13. 4

SHANGHAI.

Observations, made 1848—1853 on the bank of Woosung river, daily 9 a.m. and 3 p.m., (cf. Sitzungsberichte der Mathematisch-Naturwissenschaftlichen Classe der Wiener Akademie der Wissenschaften, 36 Band, Jahrgan 1859 page 164); further, observations made 1866, 1867, 1871, 1872 and 1873, (cf. Quarterly Journal of the Meteorological Society, 1874, October, page 234), daily observations of the Maximum and Minimum at Zi-ka-wei; lastly observations 8 times daily, 1 a.m., 4 a.m., 7 a.m., 10 a.m., 1 p.m., 4 p.m., 7 p.m., and 10 p.m., also at Zi-ka-wei. The 24 hourly means are, calculated by means of our tables (4), (8) and (10), and are given in following table:

102	Jan.	Feb.	Mar.	Apr.	May.	June.
1848...	3.°6	3.°1	7.°9	12.°4	19.°0	21.°7
1849...	4. 9	7. 8	9. 6	12. 5	17. 0	21. 8
1850...	2. 4	3. 6	7. 6	13. 1	19. 6	22. 8
1851...	4. 4	4. 3	7. 6	10. 5	16. 2	22. 2
1852...	4. 5	4. 0	6. 8	12. 1	18. 8	24. 6
1853...	4. 4	3. 5	8. 8	12. 4	18. 0	21. 6
1866...	3. 8	4. 9	8. 2	11. 2	18. 6	22. 4
1867...	2. 9	4. 7	9. 9	13. 8	18. 5	24. 0
1871...	3. 6	4. 8	9. 3	13. 9	19. 8	25. 0
1872...	3. 3	2. 9	9. 4	15. 4	19. 5	21. 8
1873...	2. 7	4. 4	7. 0	15. 7	19. 0	22. 3
1875...	...	...	...	13. 0	19. 8	22. 4
1876...	1. 2	5. 3	9. 0	...	...	...
Mean..	3. 5	4. 4	8. 4	13. 0	18. 6	22. 7

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1848...	25.°7	25.°3	23.°0	16.°8	9.°5	7.°4	14.°6
1849...	25. 5	26. 8	24. 7	16. 8	10. 5	5. 7	15. 3
1850...	27. 1	27. 5	20. 8	17. 4	10. 5	4. 8	14. 8
1851...	27. 9	26. 0	21. 9	17. 2	12. 4	6. 9	14. 8
1852...	30. 0	28. 2	25. 4	18. 1	12. 5	4. 3	15. 8
1853...	29. 0	26. 8	23. 5	16. 8	10. 7	5. 1	15. 0
1866...	29. 0	28. 7	21. 9	16. 7	9. 8	6. 3	15. 1
1867...	28. 8	26. 9	21. 7	17. 8	8. 4	6. 7	15. 3
1871...	29. 0	28. 5	25. 8	19. 1	11. 2	3. 0	16. 1
1872...	29. 6	27. 2	22. 9	17. 4	11. 2	8. 4	15. 7
1873...	27. 9	26. 3	22. 6	15. 9	11. 2	7. 1	15. 2
1875...	28. 1	26. 3	22. 2	17. 1	10. 3	2. 9	14. 8
1876...	...	...	...	...	...	...	...
Mean..	28. 1	27. 0	23. 0	17. 3	10. 7	5. 7	15. 21

FU-CHEU-FOO.

Observations, published by "The *Chinese Recorder and Missionary Journal*, Foochow, Editor, Rev. Justus Doolittle, June 1870—December 1870.

There were noticed during the 8 months, April 1870—December 1870, the daily Maximum and Minimum of the Temperature and the Temperature at 9 a.m. By the help of our table (4), I have calculated the following 24 hourly means:

103	Jan.	Feb.	Mar.	Apr.	May.	June.
From 9 a.m..........	...	...	...	17.°2	19.°7	27.°0
,, Max. & Min..	...	...	...	19. 1	21. 4	27. 7
Mean	...	...	...	18. 1	20. 5	27. 8
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
From 9 a.m..........	27. 7	27. 5	25. 2	22. 6	17. 0	13. 4
,, Max. & Min..	29. 0	27. 8	25. 5	22. 6	17. 2	14. 0
Mean	28. 3	27. 6	25. 3	22. 6	17. 1	13. 7

The comparison of (103) and (106) gives:

104		
	From April	17.°7
	,, May..................................	17. 1
	,, June	20. 5
	,, July..................................	21. 3
	,, August	21. 4
	,, September	20. 3
	,, October	21. 1
	,, November	20. 9
	,, December	22. 0
	Mean	20. 3

CANTON.

Observations published in "F. J. F. Meyen, Ueber das Clima des Sündlichen China;" Times of observation Noon and Midnight. The 24 hourly means, calculated by the help of table (17), are:

105	Jan.	Feb.	Mar.	Apr.	May.	June.	
1829 ...	12.°1	11.°0	17.°2	20.°6	25.°1	28.°9	
1830 ...	12. 8	16. 8	17. 9	20. 6	24. 0	27. 8	
1831 ...	13. 3	9. 1	19. 8	22. 0	23. 1	27. 3	
Mean...	12. 7	12. 3	18. 3	21. 1	24. 1	28. 0	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1829 ...	27.°8	27.°5	26.°4	22.°0	18.°1	13.°5	20.°9
1830 ...	27. 0	26. 3	24. 9	22. 8	16. 9	11. 4	20. 8
1831 ...	28. 4	27. 0	25. 7	21. 8	15. 6	12. 3	20. 5
Mean...	27. 7	26. 9	25. 7	22. 2	16. 9	12. 4	20. 7

Therefore the deviations of the annual mean from the monthly means:

	Jan.	Feb.	Mar.	Apr.	May.	June.
106	+8.°0	+8.°4	+2.°4	—0.°4	—3.°4	—7.°3
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	—7.°0	—6.°2	—5.°0	—1.°5	+3.°8	+8.°3

SAIGON.

Observations published in "Bull. Held. de l'Ass. Sc. de France, Sept. 1869, No. 136." Times of observation 6 a.m., 10 a.m., 4 p.m. and 10 p.m. The reduction to 24 hourly means is made according our table (8).

	Jan.	Feb.	Mar.	Apr.	May.	June.	
107	25.°5	26.°4	27.°6	28.°8	28.°3	27.°3	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	27.°3	26.°6	26.°6	27.°1	26.°4	26.°6	27.°0

BANGKOK.

The following observations, table (108) are calculated by Dr. J. Hann and published in "Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie Band VII pag. 23." The observer has been Dr. Campbell.

108	Jan.	Feb.	Mar.	Apr.	May.	June.	
1858—61...	25.°1	25.°3	28.°0	28.°2	28.°2	27.°9	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1858—61...	27.°7	27.°5	27.°1	26.°8	25.°4	24.°3	26.°8

PETROPAULOVSK.

From the "Sapiski" of the Hydrographical Department, calculated by the Physical Central-Observatory at St. Petersburg.

MONTHLY MEANS OF THE TEMPERATURE.

109	Jan.	Feb.	Mar.	Apr.	May.	June.
1845...	......	......	......	......	......	......
1846...	—14.°5	—7.°8	—2.°7	—2.°4	3.°9	12.°0
1848...	......	—7. 5	—1. 1	1. 6	4. 9	10. 9
1849...	—6. 1	—9. 8	—7. 4	0. 7	5. 2	9. 8
1850...	—8. 3	—10. 8	—0. 8	1. 1	5. 3	......
1851...	—7. 8	—13. 7	—10. 8	—2. 5	4. 6	......
1852...	......	—9. 0	—5. 1	—2. 8	2. 8	......
1853...	—4. 5	—9. 6	—4. 8	—4. 2	3. 0	7. 7
Mean..	—8. 24	—9. 74	—4. 67	—1. 21	4. 24	10. 10

PETROPAULOVSK.—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1845...	......	......	......	......	......	—4.°5	......
1846...	14.°0	15.°7	10.°4	5.°3	—0.°4	—6. 6	2.°24
1848...	13. 9	14. 0	10. 1	2. 8	—2. 5	—6. 0	......
1849...	16. 1	15. 3	9. 6	5. 0	—3. 5	—5. 1	2. 48
1850...	......	15. 6	11. 0	3. 6	—2. 4	—9. 1	......
1851...	......	......	......	......	......	......	......
1852...	......	......	......	4. 6	—1. 5	—4. 8	......
1853...	13. 9	14. 1	11. 7	6. 2	1. 8	—5. 3	2. 50
Mean..	14. 47	14. 94	10. 56	4. 58	—1. 42	—5. 91	2. 31

HAKODATE.

Observations made 1859—1863 by Dr. Albrecht, (see Correspondance Meteorologique par Kupffer, years 1858, 1861, 1862 and 1863 and Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Band V pag. 39); the observations for 1859—1860 and 1868—1870 are printed in "Japan Gazette, 11th March, 1871, and Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, Band VI pag. 252." The observations 1859—1863 are calculated by means of the formula $\frac{7\text{ a.m.} + 2\text{ p.m.} + 2{,}9\text{ p.m.}}{4}$ these of 1859—1860 and 1868—1870 by the formula $\frac{\text{Max.} + \text{Min.}}{2}$ and corrected according to our tables resp. (14) and (9).

110	Jan.	Feb.	Mar.	Apr.	May.	June.
1859—63	—2.°2	—1.°6	2.°0	6.°9	11.°3	15.°3
1859—60 & 1868—70.	—3. 1	—1. 3	1. 4	6. 7	11. 5	14. 8
Mean	—2. 6	—1. 5	1. 7	6. 8	11. 4	15. 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of Years Obvd.
1859—63	20.°1	22. 4	18.°1	11.°8	6.°0	0.°1	9.°2	5
1859—60 & 1868—70.	18. 2	20. 4	17. 8	11. 6	4. 9	0. 2	8. 6	5
Mean	19. 1	21. 4	18. 0	11. 7	5. 5	0. 1	8. 9	10

NIIGATA.

Taken from "Mittheilungen der Deutschen Gesellschaft für Natur-und Volker-kunde Ostasiens, Heft 3, September 1873; and Zeitschrift der Ost. Gesell. fur Meteorologie, Band VIII, page 236."

Observations, made by A. R. Weber, Esq.; hours of observation not known.

Mean of the three years—1870, 1871 and 1872:

111	Jan.	Feb.	Mar.	Apr.	May.	June.	
	0.°0	0.°1	4.°4	11.°1	16.°0	20.°2	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	25.°3	26.°6	22.°6	17.°1	10.°3	3.°4	13.°1

YEDO.

Observations made by Erwin Knipping, Esq., and published in "Mittheilungen der Deutschen Gesellschaft für Natur und Volker kunde Ostasiens. Calculated by the formula $\frac{7\text{ a.m.}+2\text{ p.m.}+2.9\text{ p.m.}}{4}$, and corrected by me according to table (14) on —0.°1 Celsius.

TWENTY-FOUR HOURLY MEANS.

112	Jan.	Feb.	Mar.	Apr.	May.	June.	
1872...	...	...	...	...	...	...	
1873...	2.°0	2.°3	5.°6	13.°4	17.°6	19.°4	
1874...	3. 0	4. 1	7. 0	12. 0	16. 4	21. 7	
Mean..	2. 5	3. 2	6. 3	12. 7	17. 0	20. 5	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1872...	...	...	...	15.°9	9.°9	5.°4	
1873...	25.°1	26.°4	21.°6	15. 3	8. 4	5. 4	
1874...	23. 8	25. 8	20. 8	...	...	...	
Mean..	24. 5	26. 1	21. 2	15. 6	9. 1	5. 4	13.°67

KANAGAWA.

Observations taken from "Zeitschrift der Osterreichisshen Gesellschaft fur Meteorologie Band VI, page 252." Table (113) calculated by Dr. J. Hann, by the help of the daily observed Maximum and Minimum of the Temperature.

MEANS OF THE TEMPERATURE.

113	Jan.	Feb.	Mar.	Apr.	May.	June.	
1860...	3.°6	4.°2	7.°5	13.°6	17.°5	21.°9	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1860...	25.°8	27.°2	24.°4	17.°5	10.°8	6.°7	15.°1

YOKOHAMA.

The observations made during 1863—1869, by Dr. Hepburn, are published in "Transactions of the Asiatic Society of Japan, from 22nd October, 1873, to 15th July, 1874," and reduced by me by means of the table (16).

The series 1865* is procured by Dr. Mourier, and taken from "Zeitschrift der Oester. Gesellschaft fur Meteorologie, Band VII, page 47.

1870 I have also taken from "Zeitschrift der Oester. Gesell. für Meteorologie, Band VII, page 36 and corrected by means of our table (14).

114	Jan.	Feb.	Mar.	Apr.	May.	June.	
1863...	4.°1	4.°6	9.°1	12.°4	17.°3	21.°8	
1864...	1. 6	3. 1	5. 9	13. 7	17. 3	20. 2	
1865...	3. 8	6. 5	7. 6	14. 3	18. 1	21. 3	
1865*.	4. 3	6. 7	7. 8	14. 3	18. 2	21. 3	
1866...	3. 8	3. 4	8. 5	12. 1	15. 9	18. 2	
1867...	5. 4	3. 8	9. 3	13. 0	17. 4	21. 1	
1868...	5. 3	4. 8	7. 1	13. 7	18. 2	20. 4	
1869...	5. 4	7. 0	7. 6	11. 6	17. 0	20. 3	
1870...	3. 1	4. 6	9. 2	13. 6	17. 0	21. 1	
Mean..	4. 1	4. 9	8. 0	13. 2	17. 4	20. 6	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1863...	26.°2	27.°3	20.°2	15.°1	11.°3	5.°2	14.°5
1864...	24. 2	26. 0	20. 9	16. 6	10. 8	6. 5	13. 9
1865...	22. 4	26. 3	22. 1	15. 9	10. 3	6. 5	14. 6
1865*.	22. 6	26. 8	22. 4	15. 5	10. 4	6. 1	14. 7
1866...	23. 0	24. 8	19. 7	16. 0	10. 0	5. 4	13. 4
1867...	24. 0	26. 4	21. 5	17. 1	10. 4	7. 2	14. 7
1868...	24. 5	23. 6	21. 0	15. 3	11. 5	6. 8	14. 3
1869...	21. 5	23. 6	22. 4	16. 4	10. 3	4. 8	14. 0
1870...	21. 5	25. 5	23. 9	18. 0	12. 1	7. 7	14. 8
Mean..	23. 3	25. 6	21. 6	16. 2	10. 8	6. 2	14.32

OSAKA.

Observations made by Dr. Gratana. Cf. Zeitschrift der Osterr. Gesellschaft für Meteorologie, Band VI, page 251.

115 1870.	Jan.	Feb.	Mar.	Apr.	May.	June.
8 a.m..........	1.°9	4.°2	7.°5	13.°2	16.°6	22.°0
Noon	7. 9	9. 9	13. 5	17. 3	20. 5	24. 2
10 p.m.	2. 6	4. 9	8. 0	12. 3	16. 2	25. 1
Mean correct.	4. 1	6. 5	9. 6	13. 9	17. 5	22. 7

OSAKA.—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
8 a.m.	25.°2	26.°8	23.°2	17.°8	11.°5	5.°1	
Noon	28. 8	28. 6	27. 6	22. 9	17. 9	12. 3	
10 p.m.	24. 8	26. 6	22. 7	17. 3	12. 1	6. 5	
Mean correct.	26. 0	27. 2	24. 4	19. 1	13. 6	7. 9	16.°0

DECIMA.

Observations taken from "Meteorologische Waarnemingen in Nederland en zijne Berittingen 1856, page 284. The monthly means, calculated by Buy Ballot, I have corrected by —0. 10 C., according to table (9).

116	Jan.	Feb.	Mar.	Apr.	May.	June.
1845...	7.°89	7.°81	10.°51	15.°02	19.°25	22.°90
1846...	4. 31	6. 24	8. 00	15. 59	16. 86	21. 72
1847...	6. 46	6. 19	9. 28	16. 11	19. 30	21. 76
1848...	5. 77	6. 51	9. 64	15. 40	20. 77	22. 10
1849...	5. 98	10. 28	11. 19	14. 62	18. 87	21. 70
1850...	5. 30	...	...	...	...	...
1851...	6. 26	5. 68	9. 75	13. 84	18. 19	19. 84
1852...	5. 00	4. 18	8. 01	12. 78	18. 18	22. 44
1853...	...	...	...	...	...	...
1854...	5. 81	6. 23	9. 34	12. 68	17. 95	21. 32
1855...	3. 33	4. 52	9. 44	15. 10	18. 39	22. 10
Mean..	5. 61	6. 40	9. 46	14. 57	18. 64	21. 76

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1845...	27.°27	27.°28	22.°98	17.°80	11.°32	...	...
1846...	25. 42	28. 47	25. 82	19. 65	12. 19	5.°93	15.°85
1847...	26. 64	29. 83	24. 60	18. 23	14. 83	9. 17	16. 87
1848...	27. 18	27. 70	24. 27	19. 68	11. 31	8. 98	16. 61
1849...	24. 69	27. 65	25. 67	18. 33	11. 16	9. 35	16. 62
1850...	25. 88	26. 02	23. 68	18. 67	12. 76	7. 79	...
1851...	26. 04	26. 96	23. 02	17. 51	15. 12	7. 55	15. 81
1852...	27. 44	27. 24	24. 19	...	...	6. 78	...
1853...	...	...	...	16. 42	13. 04	...	...
1854...	25. 38	26. 72	23. 31	16. 70	11. 73	6. 84	15. 33
1855...	26. 20	25. 12	23. 93	...	...	6. 12	...
Mean..	26. 21	27. 30	24. 15	18. 11	12. 61	7. 61	16. 04

NAFA.

Taken from "Zeitschrift der Oester. Gesellschaft fur Meteorologie, Band VII, page 46"; observations made by Pater Furet during the period December 1856—September 1858, and published in "Comptes rendus LXVIII." Hours—6 a.m., 1 p.m. and 10 p.m. The reduction of $\frac{6\text{ a.m.}+1\text{ p.m.}+10\text{ p.m.}}{3}$ to 24 hourly means, I have made by the help of table (15) Decima.

117							
	Jan.	Feb.	Mar.	Apr.	May.	June.	
	16.°3	15.°9	18.°1	20.°6	24.°4	26.°5	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	28.°8	27.°9	27.°3	25.°8	21.°3	18.°5	22.°6

KELUNG.

Observations made at the I. M. Custom-House, by N. N. Titushkin, Esq. Instruments partly from the I. Russian Observatory at Peking, partly from the Customs; instruction from the I. R. Observatory at Peking.

118	7 a.m.	1 p.m.	8 p.m.	Mean.
Jan. 1874	13.°5	14.°9	14.°3	14.°2
,, 75	14. 2	15. 2	14. 6	14. 7
Feb. 1874	14. 3	15. 6	14. 9	14. 9
,, 75	14. 0	15. 8	14. 4	14. 7
Mar. 1874	15. 3	16. 6	15. 8	15. 9
,, 75	16. 3	18. 7	17. 2	17. 4
Apr. 1874	18. 0	20. 5	18. 9	19. 1
,, 75	18. 1	20. 8	18. 9	19. 3
May 1874	22. 8	25. 0	23. 5	23. 8
,, 75	22. 8	25. 1	23. 1	23. 7
June 1874	26. 5	29. 6	27. 3	27. 8
,, 75	26. 2	29. 9	27. 0	27. 7
July 1874	26. 9	30. 2	27. 8	28. 3
,, 75	27. 4	31. 3	27. 9	28. 9
Aug. 1874	26. 5	29. 9	27. 4	27. 9
Sept. 1874	26. 1	29. 4	27. 2	27. 6
,, 73	25. 3	27. 2	25. 5	26. 0
Oct. 1874	23. 1	25. 0	23. 5	23. 9
,, 73	22. 1	23. 9	22. 5	22. 8
Nov. 1874	17. 7	19. 6	18. 4	18. 6
,, 73	18. 9	20. 7	19. 6	19. 7
Dec. 1874	16. 3	18. 8	17. 1	17. 4
,, 73	15. 4	18. 9	16. 7	17. 0

Mean from all observations during 23 months, September 1873—July 1875.

119	Jan.	Feb.	Mar.	Apr.	May.	June.	
7 a.m..........	13.°8	14.°1	15.°8	18.°0	22.°8	26.°3	
1 p.m..........	15. 1	15. 7	17. 7	20. 7	25. 0	29. 8	
9 p.m..........	14. 4	14. 7	16. 5	18. 9	23. 3	27. 1	
Mean	14. 4	14. 8	16. 7	19. 2	23. 7	27. 7	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
7 a.m..........	27.°1	26.°5	25.°7	22.°6	18.°3	15.°8	20.°6
1 p.m..........	30. 7	29. 9	28. 3	24. 5	20. 1	18. 9	23. 0
9 p.m..........	27. 8	27. 4	26. 3	23. 0	19. 0	16. 9	21. 3
Mean	28. 5	27. 9	26. 8	23. 4	19. 1	17. 2	21. 6

By the help of our table (21) (Decima and Hongkong), we find the following mean monthly and annual temperatures, reduced to 24 hourly observations:

	Jan.	Feb.	Mar.	Apr.	May.	June.	
120	14.°2	14.°6	16.°4	18.°9	23.°4	27.°4	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	28.°2	27.°6	26.°5	23.°2	18.°9	17.°0	21.°4

VICTORIA,—(HONGKONG.)

Observations are made at three places (6—40 metres above the Sea-level), within the town of Victoria: 1.) By the Royal Engineers 1853—1859, 2) by the Officers of the Government Hospital 1867—1872 with interruptions; and 3) by the Officers of the Harbour, Praya West.

These observations Dr. J. Hann has calculated and published in "Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie pag. 72 and pag. 219 T. VIII.

The results are contained in the following table:

MONTHLY AND ANNUAL MEANS OF THE TEMPERATUUE.

121	Jan.	Feb.	Mar.	Apr.	May.	June.
Victoria Royal Engineers ..	15.°1	15.°3	18.°1	21.°7	25.°8	27.°2
Victoria Hospital..........	15. 2	16. 1	18. 2	22. 8	25. 9	28. 3
Victoria Praya West	15. 7	14. 6	18. 4	23. 8	26. 4	28. 7
Mean	15. 3	15. 3	18. 2	22. 8	26. 0	28. 1

VICTORIA,—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Victoria Royal Engineers ..	28.°2	27.°4	27.°2	24.°2	20.°6	17.°4	22.°4
Victoria Hospital..........	28. 7	28. 2	26. 4	24. 6	19. 4	15. 7	22. 5
Victoria Praya West	29. 2	28. 6	26. 6	23. 9	19. 6	15. 8	22. 6
Mean	28. 7	28. 6	26. 7	24. 2	19. 9	16. 3	22. 5

Further Dr. Hann has also reduced observations made at Victoria Peak during 2½ years, 1870—1872.

122	Jan.	Feb.	Mar.	Apr.	May.	June.	
Victoria Peak, Block House.	12.°7	11.°8	15.°2	19.°6	22.°5	23.°9	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Victoria Peak, Block House.	24.°0	24.°1	23.°3	21.°2	16.°3	13.°4	19.°0

MACAO.

Observations made by Beale 1827—1830, daily at 6 a.m. and 7 p.m., and by Blettermann 1841 at 7 a.m. and 2½ p.m., taken from "Meyen, Bemerkungen uber die Klimatischen Verheiltmisse des sudlichen Chinas, 1835." I have the Data of Meyen by means of tables (19) and (20) reduced to 24 hourly mean temperatures and in (123) inscribed.

123	Jan.	Feb.	Mar.	Apr.	May.	June.	
1827 ...	......	......	18.°2	23.°6	25.°3	27.°6	
1828 ...	16.°4	13.°1	17. 3	19. 8	26. 2	27. 6	
1729 ...	......	12. 1	16. 4	20. 7	25. 0	27. 9	
1830 ...	......	......	18. 7	21. 7	25. 1	27. 8	
1831 ...	17. 0	14. 6	19. 1	22. 6	24. 2	27. 6	
Mean...	16. 7	13. 3	17. 9	21. 7	25. 2	27. 7	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1827 ...	28.°5	27.°7	27.°5	25.°5	20.°1	18.°0	...
1828 ...	28. 0	28. 4	27. 7	22. 9	19. 4	17. 8	22.°1
1829 ...	27. 7	28. 2	27. 4	23. 9	17. 9	14. 4	...
1830 ...	27. 0	27. 8	26. 6	25. 3	21. 1	14. 2	...
1831 ...	29. 3	27. 8	27. 3	24. 0	18. 6	17. 0	22. 4
Mean...	28. 1	28. 0	27. 3	24. 3	19. 4	16. 3	22. 2

PEKING.

DAILY MEANS OF THE TEMPERATURE.

Calculated from Observations during 33 years, 1841—1874,
124 at 7 a.m., 1 p.m., and 9 p.m. daily.

Date.	Jan.	Feb.	Mar.	Apr.	May.	June.
1	—4.°4	—3.°4	1.°6	8.°8	17.°2	22.°1
2	—4.7	—3.2	1.7	8.8	17.2	22.9
3	—4.4	—3.4	2.1	9.3	17.4	23.1
4	—3.7	—3.4	1.7	10.5	18.2	23.5
5	—4.5	—3.1	1.5	10.8	17.3	23.7
6	—4.9	—2.2	1.8	10.5	17.3	23.1
7	—4.5	—2.6	2.9	10.9	17.7	23.7
8	—4.4	—3.0	3.4	11.8	18.1	24.6
9	—4.9	—3.5	3.9	11.8	19.1	25.0
10	—5.2	—3.0	3.9	12.4	19.2	24.3
11	—4.5	—1.5	3.5	12.9	19.2	23.4
12	—4.1	—2.0	3.8	13.1	18.6	23.9
13	—4.8	—1.4	4.4	13.4	19.3	24.7
14	—5.6	—1.7	4.4	13.4	19.9	24.8
15	—5.2	—1.6	4.3	13.7	20.2	24.1
16	—5.2	—1.7	4.7	14.4	19.9	24.4
17	—5.2	—1.7	5.2	15.1	20.2	24.7
18	—4.8	—1.2	5.3	15.7	20.4	25.0
19	—4.5	—0.9	5.7	15.6	21.3	24.9
20	—4.8	—0.3	6.1	15.7	21.4	25.2
21	—5.0	0.0	6.4	15.5	20.8	25.4
22	—4.7	0.3	6.7	16.0	20.6	25.3
23	—4.0	0.3	6.5	16.7	21.4	24.6
24	—3.8	0.4	7.2	15.8	21.5	24.0
25	—4.0	0.3	8.1	15.6	21.1	21.5
26	—4.5	1.0	8.0	16.7	21.5	25.4
27	—4.5	1.1	7.6	17.1	21.3	25.0
28	—3.9	1.0	7.2	16.9	21.6	24.6
29	—4.5	...	8.3	17.2	21.9	25.1
30	—4.7	...	8.6	17.5	22.6	25.1
31	—4.2	...	9.5	...	23.0	...

PEKING.—*Continued.*

DAILY MEANS OF THE TEMPERATURE.

Calculated from Observations during 33 years, 1841—1874,
124 at 7 a.m., 1 p.m. and 9 p.m. daily.

Date.	July.	Aug.	Sept.	Oct.	Nov.	Dec
1	25.°0	26.°3	23.°5	16.°4	8.°7	—0.°1
2	25. 5	25. 8	23. 7	16. 1	8. 5	—0. 4
3	25. 4	26. 1	23. 3	16. 0	8. 0	—0. 6
4	25. 4	25. 3	22. 6	15. 4	7. 4	—0. 7
5	25. 1	25. 3	22. 6	15. 4	7. 0	—0. 3
6	25. 2	25. 3	22. 2	15. 0	6. 4	0. 0
7	25. 4	24. 8	21. 8	15. 2	6. 6	—0. 6
8	26. 1	25. 3	21. 7	15. 3	5. 9	—1. 3
9	26. 1	25. 1	21. 5	14. 2	4. 9	—1. 4
10	26. 4	25. 2	20. 6	14. 2	4. 9	—1. 4
11	25. 8	25. 3	20. 8	14. 2	5. 8	—2. 1
12	26. 2	25. 4	20. 4	13. 8	5. 1	—2. 4
13	26. 0	25. 3	19. 4	13. 4	4. 2	—2. 0
14	25. 9	25. 1	19. 5	13. 8	4. 1	—1. 9
15	26. 5	24. 6	19. 3	14. 2	3. 6	—2. 4
16	25. 7	24. 8	19. 8	13. 9	3. 5	—2. 3
17	25. 8	24. 5	19. 4	12. 6	3. 6	—3. 3
18	26. 2	24. 8	18. 9	12. 0	3. 1	—3. 4
19	26. 4	24. 9	19. 0	11. 3	2. 6	—3. 3
20	26. 6	24. 3	19. 4	10. 6	3. 1	—2. 7
21	26. 8	24. 0	18. 9	10. 5	2. 8	—2. 6
22	26. 8	23. 9	19. 0	10. 5	1. 9	—2. 8
23	26. 5	23. 2	18. 7	9. 5	1. 2	—2. 7
24	26. 1	23. 1	18. 6	10. 0	0. 3	—2. 9
25	25. 8	23. 4	18. 0	10. 0	—0. 1	—2. 8
26	26. 3	23. 4	18. 2	10. 1	0. 1	—4. 1
27	26. 8	23. 2	17. 9	9. 8	1. 1	—4. 0
28	26. 6	23. 3	17. 7	8. 8	0. 1	—4. 9
29	26. 3	23. 5	17. 2	7. 9	0. 0	—5. 6
30	26. 7	23. 1	16. 5	8. 2	—0. 9	—5. 0
31	26. 7	23. 4	...	8. 4	...	—5. 3

ABSOLUTE TEMPORAL VARIABILITY OF THE MONTHLY AND ANNUAL MEANS OF THE TEMPERATURE

CONTINENT OF EASTERN ASIA.

125	Jan.	Feb.	Mar.	Apr.	May.	June.
Yakutsk	15.°0	12.°2	12.°7	8.°2	8.°0	7.°5
Okhotsk	9. 0	9. 9	10. 0	3. 6	4. 0	3. 9
Nikolajevsk	15. 4	5. 9	7. 1	8. 0	6. 1	8. 2
Nerchinsk	14. 9	10. 8	13. 0	8. 5	8. 7	6. 0
Peking	5. 8	8. 2	5. 8	6. 0	4. 2	4. 7
Shanghai	3. 7	4. 9	3. 1	5. 2	3. 6	3. 4

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of Years observed.
Yakutsk	9.°7	8.°1	6.°4	10.°0	14.°1	12.°1	...	...
Okhotsk	3. 9	3. 5	3. 8	6. 7	8. 8	10. 1	1.°7	7—10
Nikolajevsk	6. 6	6. 0	5. 3	5. 7	7. 9	11. 9	2. 5	16
Nerchinsk	5. 0	4. 7	4. 7	6. 7	10. 3	10. 2	...	...
Peking	4. 0	2. 5	3. 9	3. 8	6. 4	6. 8	2. 3	33
Shanghai	4. 5	3. 4	5. 0	3. 2	4. 1	5. 5	1. 5	12

ISLANDS OF EASTERN ASIA.

126	Jan.	Feb.	Mar.	Apr.	May.	June.
Yokohama	3.°8	3.°9	3.°4	2.°7	2.°3	3.°6
Decima	4. 6	6. 1	3. 2	3. 4	3. 9	3. 1

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of Years observed.
Yokohama	4.°7	3.°7	4.°2	2.°9	2.°1	2.°9	1.°4	9
Decima	2. 8	4. 7	2. 8	3. 3	4. 0	3. 4	1. 5	6—10

ABSOLUTE TEMPORAL VARIABILITY OF THE MONTHLY MEANS OF THE TEMPERATURE,
Tabulated by Dove (Cf. Dove, Klimatologische Beitrage II, page 233).

127	Jan.	Feb.	Mar.	Apr.	May.	June.
Ural and Western Siberia	15.°5	14.°1	11.°4	8.°9	8.°6	6.°5
Europe, Russia	15. 8	15. 9	11. 6	9. 1	8. 9	8. 0
Germany	13. 6	11. 4	11. 2	8. 7	7. 9	6. 6
Alps	12. 1	9. 8	8. 7	7. 6	7. 1	6. 6
Italy	7. 2	7. 5	7. 0	6. 1	7. 0	5. 7
Western Europe (Continent)	11. 5	9. 1	8. 1	6. 5	6. 2	6. 1
Scandinavia	9. 6	10. 0	8. 5	5. 5	6. 4	7. 4
England	8. 9	7. 1	6. 1	5. 9	6. 0	6. 0
Eastern North America	9. 0	10. 1	8. 5	6. 0	5. 9	5. 5
Interior of North America	11. 7	12. 4	13. 1	9. 9	6. 6	6. 0
Iceland and Greenland	9. 9	10. 0	9. 7	6. 9	6. 1	5. 9
West Coast of N. America	11. 6	8. 9	8. 2	4. 0	3. 7	4. 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	No. of Stations.	Latitude.
Ural and Western Siberia	5.°8	6.°1	6.°8	9.°5	11.°7	15.°0	6	53°—62°
Europe, Russia	8. 0	8. 0	7. 6	7. 6	10. 8	14. 6	9	47 —60
Germany	7. 1	7. 8	5. 9	7. 2	8. 4	13. 5	21	51
Alps	6. 7	6. 1	6. 2	6. 4	9. 0	10. 6	5	46
Italy	6. 0	5. 6	6. 0	5. 7	7. 4	8. 0	5	43
Western Europe (Continent)	6. 1	6. 1	5. 2	6. 1	7. 5	10. 5	5	50
Scandinavia	8. 8	7. 9	4. 7	6. 7	9. 1	10. 4	3	62
England	5. 5	4. 6	4. 9	5. 7	6. 1	7. 7	7	54
Eastern North America	5. 2	5. 2	5. 1	6. 1	7. 4	10. 2	10	38
Interior of North America	6. 0	5. 6	6. 6	7. 7	9. 2	11. 9	9	38
Iceland and Greenland	7. 0	6. 6	6. 0	6. 4	6. 9	11. 5	2	...
West Coast of N. America	3. 9	4. 1	4. 1	4. 2	14. 0	9. 7	1	58

MONTHLY AND ANNUAL MEANS OF THE TEMPERATURE.

CONTINENT OF EASTERN ASIA. TABLE (128).

	Long.	Lat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of Years Ob'ved.	Sources, from which the data in tables (128) and (129) have been obtained.
Yakutsk	129°45′	62.° 2′	—40.°8	—34. 9	—22.°6	—8.°8	3.°3	13.°2	17.°4	13. 9	4. 5	—9.°0	—28.°4	—38.°8	—10.°9	25	Dove Klimatologische Beitrage, page 97.
Okhotsk	143. 17	59. 21	—24. 3	—22. 9	—13. 7	—6. 2	2. 3	8. 2	13. 1	13. 5	8. 4	—3. 3	—14. 7	—23. 4	—5. 3	9	Table (69).
Ayan	138. 17	56. 28	—20. 9	—15. 7	—10. 4	—4. 5	1. 6	7. 6	12. 6	12 1	8. 0	—2. 2	—11. 9	—19. 4	—3. 6	5	Wesselofsky "on the Climate of Russia" p. 33, Apx. I.
Udskoi	134. 59	54. 30	—27. 6	—25. 9	—11. 2	—2. 1	3. 9	13. 4	16. 1	15. 2	11. 0	—1. 5	—17. 4	—29. 7	—4. 6	1	Dove, Klimatologische Beitrage, page 97.
Nicolajevsk	140. 43	53. 8	—24. 5	—21. 4	—14. 3	—3. 7	3. 6	12 1	16. 2	15. 7	9. 9	1. 6	—10. 2	—20. 4	—2. 9	15	Table (70).
Mariinsk	140. 11	51. 42	—21. 4	—18. 2	—11. 1	—0. 5	6. 7	15. 2	19. 4	18. 9	13. 0	4. 7	—7. 1	—17. 2	0. 2	..	Reduced to 15 yearly means by means of (70 ; Cf. [Schrenck T. IV.
Urga	106. 51	47. 55	—27. 8	—22. 1	—11. 3	0. 8	8. 2	14 2	17. 6	14. 8	9. 4	—1. 8	—14. 0	—22. 7	—2. 9	4	Table (72).
Nerchinsk	119. 37	51. 18	—29. 2	—24. 1	—12. 5	—1. 0	8. 0	15. 4	18. 0	15. 3	8. 2	—2. 2	—16. 4	—26. 9	—3. 9	21	St. Petersburger Repertorium fur Meteorologie T. I. p. [86.
Blagoveshchensk ..	127. 37	50. 15	—26. 5	—20. 7	—10. 1	2. 6	11. 2	17. 4	22. 1	20. 5	12. 6	2. 2	—13. 0	—24. 7	—0. 5	$2\frac{5}{12}$	Schrenck T. IV, p. 345.
Imperial Harbour..	140. 19	49. 1	—19. 4	—19. 5	—15. 6	..	..	..	17. 0	16. 9	12. 0	2. 7	—9. 2	—12. 7	..	..	" " p. 346.
Olga B	135. 19	43. 46	—12. 2	—8. 7	—1. 5	4. 7	..	..	..	..	..	..	..	—9. 6	..	..	" " p. 356.
Vladivostok	132. 0	43. 9	—16. 0	—11. 0	—3. 8	3. 5	8. 5	13. 6	18. 7	19. 8	15. 1	8. 5	—1. 5	—10. 5	3. 7	3	Table (73).
Possjet	130. 54	42. 40	—15. 5	—10. 5	0. 0	5. 4	9. 4	15. 2	19. 4	23. 0	..	..	..	—9. 5	..	..	Schrenck T. IV, p. 346.
Si-wan-tse	115. 18	40. 59	—16. 7	—11 7	—3. 0	3. 2	11. 9	16. 9	19. 5	17 0	11. 4	3. 9	—6. 9	—11. 7	2. 8	2	Table (79)
Kalgun	114. 55	40. 51	—11. 1	—8. 4	..	..	..	..	..	23. 0	17. 6	7. 9	—1. 9	—8. 7	6. 8	..	Tables (80) and (81).
Newchwang	122. 13	40. 41	—12. 0	—7. 5	—0. 1	8. 6	15. 7	22. 0	25. 4	24. 1	18. 5	10. 3	3. 1	—7. 0	8. 4	2	Table (83)
Peking	116. 29	39. 57	—4. 6	—1. 4	5. 1	13. 8	19. 9	24. 3	26. 1	24. 6	20. 1	12. 5	3. 8	—2. 4	11. 8	33	Table (85).
Tientsin	117. 11	39. 7	—2. 3	0. 2	6. 0	13. 3	19. 2	24 2	27. 1	25. 7	22. 2	14. 6	4. 7	—0. 1	12. 9	1	Table (87).
Taku	117. 40	38. 59	—4. 6	—2. 3	4. 4	11. 9	18. 8	23. 6	27. 1	26. 0	20. 8	12. 8	4. 1	—2. 5	11. 7	3	Table (95).
Chefoo	121. 25	37. 33	—1. 3	..	..	..	..	..	26. 4	25. 0	21. 3	15. 5	6. 3	3. 7	13. 4	..	Tables (98) and (101).
Shanghai	121. 20	31. 12	3. 5	4. 4	8. 4	13. 0	18. 6	22. 7	28. 1	27. 0	23. 0	17. 3	10. 7	5. 7	15. 2	12	Table (102).
Fu-cheu-foo	119. 22	26. 3	..	..	..	18. 1	20. 5	27. 8	28. 3	27. 6	25. 3	22. 6	17. 1	13. 7	20. 3	..	Tables (103) and (104).
Canton	113. 17	23. 8	12. 7	12. 3	18. 3	21. 1	24. 1	28. 0	27. 7	26. 9	25. 7	22. 2	16. 9	12. 4	20. 7	3	Table (105).
Saigon............	106. 42	10. 47	25. 5	26. 4	27. 6	28. 8	28. 3	27. 3	27. 3	26. 6	26. 6	27. 1	26. 4	26. 6	27 0	1	Table (107).
Bangkok	100. 25	13. 43	25. 1	25. 3	28. 0	28. 2	28. 2	27. 9	27. 7	27. 5	27. 1	26. 8	25. 4	24. 3	26. 8	3	Table (108).

ISLANDS OF EASTERN ASIA. TABLE (129).

	Long.	Lat.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of Years Ob'ved.	
Petropaulovsk	158°48′	53. 0′	—8.°2	—9.°7	—4.°7	—1.°2	4.°2	10.°1	14.°5	14.°9	10.°6	4.°6	—1.°4	—5.°9	2.°3	6	Table (109).
Dui	142. 26	50. 50	—14. 9	—13. 9	—7. 9	0. 5	5. 6	10. 9	14.7	16. 6	11. 7	5. 0	—5. 2	—13. 6	0, 8	4	Schrenck T. VI, p. 346.
Kussunai	142. 20	48. 0	—13. 1	—12. 2	—6. 2	1. 2	6. 4	10. 4	14. 9	19. 1	12. 4	6. 5	—1. 7	—9. 0	2. 4	$1\frac{0}{12}$	" " p. 346.
Aniwa Bay........	142. 52	46. 39	—10. 1	—10. 6	—4. 0	3. 7	6. 9	..	..	..	..	..	0. 4	—7 5	..	..	" " p. 346.
Hakodate	140. 45	41. 46	—2. 6	—1. 5	1. 7	6. 8	11. 4	15. 0	19. 1	21, 4	18. 0	11. 7	5. 5	0. 1	8. 9	10	Table (110).
Niigata	139. 10	37. 55	0. 0	0. 1	4. 4	11. 1	16. 0	20. 2	25. 3	26. 6	22. 6	17. 1	10. 3	3. 4	13. 1	3	Table (111).
Yedo	139. 47	35. 41	2. 5	3. 2	6. 3	12. 7	17. 0	20. 5	24. 5	26. 1	21. 2	15. 6	9. 1	5. 4	13. 7	2	Table (112).
Kanagawa	139. 40	35. 30	3. 6	4. 2	7. 5	13. 6	17. 5	21. 9	25. 8	27. 2	24. 4	17. 5	10. 8	6. 7	15. 1	1	Table (113).
Yokohama	139. 40	35. 27	4. 1	4. 9	8. 0	13. 2	17. 4	20. 6	23. 3	25. 6	21. 6	16. 2	10. 8	6. 2	14. 3	9	Table (114).
Osaka	135. 10	34. 20	4. 1	6. 5	9. 6	13. 9	17. 5	22. 7	26. 0	27. 2	24. 4	19 1	13. 6	7. 9	16. 0	1	Table (115).
Nagasaki	129. 42	32. 44	5. 1	5. 7	12. 4	17. 3	20. 7	23. 4	27. 7	28. 0	24. 7	20. 5	14. 4	10. 6	17. 5	1	Zeitschrift der Oesterr. Gesellsch fur Meteorol. T. X.
Decima	129. 42	32. 44	5. 6	6. 4	9. 5	14. 6	18. 6	21. 8	26. 2	27. 3	24. 1	18. 1	12. 6	7. 6	16. 0	10	Table (116).
Nafa	128. 44	26. 13	16. 3	15. 9	18. 1	20. 6	24. 4	26. 5	28. 8	27. 9	27. 3	25. 8	21. 3	18. 5	22. 6	$1\frac{10}{12}$	Table (117).
Kelung	121. 46	25. 20	14. 2	14. 6	16. 4	18. 9	23. 4	27. 4	28. 2	27. 6	26. 5	23. 2	18. 9	17. 0	21. 4	2	Table (120).
Victoria	114. 9	22. 16,5	15. 3	15. 3	18. 2	22. 8	26. 0	28. 1	28. 7	28. 1	26. 7	24. 2	19. 9	16. 3	22. 5	12	Table (121).
Victoria Peak	114. 9	22. 16,0	12. 7	11. 8	15. 2	19. 6	22. 5	23. 9	24. 0	24. 1	23. 3	21. 2	16. 3	13. 4	19. 0	$2\frac{4}{12}$	Table (122).
Macao	113. 34	22. 11	16. 6	13. 3	17. 9	21. 7	25. 2	27. 7	28. 1	28. 0	27. 3	24. 3	19. 4	16. 3	22. 2	4—5	Table (123).
Manila	121. 0	14. 36	24. 1	25. 0	25. 9	27. 0	28. 0	27. 5	26. 9	26. 9	26. 5	26. 0	25. 3	24. 4	26. 1	4	Zeitschrift der Oester. Gesellsch. fur Meteorol. T. VIII [p. 334.

MONTHLY RANGE OF THE TEMPERATURE.

Differences between the Annual Means and the Monthly Means, reduced from Tables (128) and (129).

CONTINENT OF EASTERN ASIA. TABLE (130).

131	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Mean.	Annual Amplitude.
Yakutsk	—29.°9	—24.°0	—11.°7	+2.°1	+14.°2	+24.°1	+28.°3	+24.°8	+15.°4	+1.°9	—17.°5	—27.°9	—10.°9	58.°2
Okhotsk	—19.0	—17.6	—8.4	—0.9	+7.6	+13.5	+18.4	+18.8	+13.7	+2.0	—9.4	—18.1	—5.3	37.8
Ayan	—17.3	—12.1	—6.8	—0.9	+5.2	+11.2	+16.2	+15.7	+11.6	+1.4	—8.3	—15.8	—3.6	33.5
Udskoi	—23.0	—21.3	—6.6	+2.5	+8.5	+18.0	+20.7	+19.8	+15.6	+3.1	—12.8	—25.1	—4.6	45.8
[illegible]	—21.6	—18.5	—11.4	—0.8	+6.5	+15.0	+19.1	+18.6	+12.8	+4.5	—7.3	—17.5	—2.9	40.7
[illegible]	—21.6	—18.4	—11.3	—0.7	+6.5	+15.0	+19.2	+18.7	+11.8	+4.5	—7.3	—17.4	0.2	40.8
Urga	—24.9	—19.2	—8.4	+3.7	+11.1	+17.1	+20.5	+17.7	+12.3	+1.1	—11.1	—19.8	—2.9	45.4
Nerchinsk	—25.3	—20.2	—8.6	+2.9	+11.9	+19.3	+21.9	+19.2	+12.1	+1.7	—12.5	—23.0	—3.9	47.2
Blagoveshchensk	—26.0	—20.2	—9.6	+3.1	+11.7	+17.9	+22.6	+21.0	+13.1	+2.7	—12.5	—24.2	—0.5	48.6
Vladivostok	—19.7	—14.7	—7.5	—0.2	+4.8	+9.9	+15.0	+16.1	+11.7	+4.8	—5.2	—14.2	3.7	35.8
Si-wan-tse	—19.5	—14.5	—5.8	+0.4	+9.1	+14.1	+16.7	+14.2	+8.6	+1.1	—9.7	—14.5	2.8	36.2
New-chwang	—20.4	—15.9	—8.5	+0.2	+7.3	+13.6	+17.0	+15.7	+10.1	+1.9	—5.3	—15.4	8.4	37.4
Peking	—16.4	—13.2	—6.7	+2.0	+8.1	+12.5	+14.3	+12.8	+8.3	+0.7	—8.0	—14.2	11.8	30.7
Tientsin	—15.2	—12.7	—6.9	+0.4	+6.3	+11.3	+14.2	+12.8	+9.3	+1.7	—8.2	—13.0	12.9	29.4
Taku	—16.3	—14.0	—7.3	+0.2	+7.1	+11.9	+15.9	+14.3	+9.1	+1.1	—7.6	—14.2	11.7	32.2
Shanghai	—11.7	—10.8	—6.8	—2.2	+3.4	+7.5	+12.9	+11.8	+7.8	+2.1	—4.5	—9.5	15.2	24.6
Canton	—8.0	—8.4	—2.4	+0.4	+3.4	+7.3	+7.0	+6.2	+5.0	+1.5	—3.8	—8.3	20.7	15.6
Saigon	—1.5	—0.6	+0.6	+1.8	+1.3	+0.3	+0.3	—0.4	+0.4	+0.1	—0.6	—0.4	27.0	3.3
Bangkok	—1.7	—1.5	+1.3	+1.4	+1.4	+1.1	+0.9	+0.7	+0.3	0.0	—1.4	—2.5	26.8	3.0

ISLANDS OF EASTERN ASIA. TABLE (131).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Mean.	Annual Amplitude.
Petropaulovsk	—10.°5	—12.°0	—7.°0	—3.°5	+1.°9	+7.°8	+12.°2	+12.°6	+8.°3	+2.°3	—3.°7	—8.°2	2.°3	24.°6
Dui	—15.7	—14.7	—8.7	—0.3	+4.8	+10.1	+13.9	+15.8	+10.9	+4.2	—6.0	—14.4	0.8	31.5
Kussunai	—15.5	—14.6	—8.6	—1.2	+4.0	+8.0	+12.5	+16.7	+10.0	+4.1	—4.1	—11.4	2.4	32.2
Hakodate	—11.5	—10.4	—7.2	—2.1	+2.5	+6.1	+10.2	+12.5	+9.1	+2.8	—3.4	—8.8	8.9	24.0
Niigata	—13.1	—13.0	—8.7	—2.0	+2.9	+7.1	+12.2	+13.5	+9.5	+4.0	—2.8	—9.7	13.1	26.6
Yedo	—11.2	—10.5	—7.4	—1.0	+3.3	+6.8	+10.8	+12.4	+7.5	+1.9	—4.6	—8.3	13.7	23.6
Kanagawa	—11.5	—10.9	—7.6	—1.5	+2.4	+6.8	+10.7	+12.1	+9.3	+2.4	—4.3	—8.4	15.1	23.6
Yokohama	—10.2	—9.4	—6.3	—1.1	+3.1	+6.3	+9.0	+11.3	+7.3	+1.9	—3.5	—8.1	14.3	21.5
Osaka	—11.9	—9.5	—6.4	—2.1	+1.5	+6.7	+10.0	+11.2	+8.4	+3.1	—2.4	—8.1	16.0	23.1
Nagasaki	—12.4	—11.8	—5.1	—0.2	+3.2	+5.9	+10.2	+10.5	+7.2	+3.0	—3.1	—6.9	17.5	22.9
Decima	—10.4	—9.6	—6.5	—1.4	+2.6	+5.8	+10.2	+11.3	+8.1	+2.1	—3.4	—8.4	16.0	21.7
Nafa	—6.3	—6.7	—4.5	—2.0	+1.8	+3.9	+6.2	+5.3	+4.7	+3.2	—1.3	—4.1	22.6	12.9
Kelung	—7.2	—6.3	—5.0	—2.5	+2.0	+6.0	+6.8	+6.2	+5.1	+1.8	—2.5	—4.4	21.4	16.0
Victoria	—7.2	—7.2	—4.3	+0.3	+3.5	+5.6	+6.2	+5.6	+4.2	+1.7	—2.6	—6.2	22.5	13.4
Victoria Peak	—6.3	—7.2	—3.8	+0.6	+3.5	+4.9	+5.0	+5.1	+4.3	+2.2	—2.7	—5.6	19.0	12.3
Macao	—5.5	—8.9	—4.3	—0.5	+3.0	+5.5	+5.9	+5.8	+5.1	+2.1	—2.8	—5.9	22.2	14.8
Manila	—2.0	—1.1	—0.2	+0.9	+1.9	+1.4	+0.8	+0.8	+0.4	—0.1	—0.8	—1.7	26.1	3.9

According to (128) and (129), on the Continent of Eastern Asia the Minimum of the temperature appears generally in the first half of January, and the Maximum in the second half of July, but on the islands the Minimum appears at the end of January and the Maximum in the first half of August; therefore the Minimum as well as the Maximum on the islands of Eastern Asia appears about half a month later than on the Continent.

Also the mean annual temperature appears about half a month later on the islands than on the continent: on the continent about 13th April and 20th October, but on the islands at the end of April and end of October [cf. tables (130) and (131)]. The delay of the phase on the islands we must attribute to the influence of the water, which changes its temperature more slowly than the dry land. The same law Dove has demonstrated for the land surrounding the great lakes of North America.

According to tables (128) and (129) the monthly mean temperature of the Amoor-Territory is during 4—7 months below and 5—8 months above the freezing point; in the most northern parts of China, having a milder climate than the Amoor-Territory, there are only three months—December, January and February—below the freezing point; and on the limit between Northern and Southern China (latitude about 30°) we find not one monthly mean so low as 0° Celsius. On Yesso (Hakodate) the monthly mean temperature of December, January and February is below the freezing point; the most southern place, where the monthly mean equals 0° Celsius, is the western coast of Nipon, near the latitude 35°.

The annual amplitudes of the monthly means, compiled in tables (130) and (131), in the Amoor-Territory are very great —on an average of Yakutsk, Okhotsk—Newchwang about 42°—perhaps greater than in any other country of the globe.

After the amplitudes of the Amoor-Territory range those of Middle and Western Siberia—about 39°—; considerably greater than those of Eastern European Russia—about 30°—while those of Western Europe amount only to one-third of those of the Amoor-Territory.

In China likewise, and even in Japan, the annual amplitudes of the monthly mean temperature are comparatively very great; the thermal anomalies of the summer in Eastern Asia being positive and those of the winter negative, because the immense waterless mass of land composing Asia, produces a very hot summer and a very cold winter. Northern China, situated between the parallels 40° and 30° possesses annual amplitudes of monthly mean temperature, equal to twice those of Western Europe, and a few

degrees greater than those of Japan on the same latitudes; only Canton, Nafa, Kelung, Victoria and Macao, located not far from the Tropic of Cancer, have almost the same amplitude as Western Europe: and lastly Saigon, Bangkok and Manila, lying near the parallel 15°, have small amplitudes, corresponding to the tropical sea-climate. The annual amplitude at Saghalin is great, but smaller than the amplitude of the opposite continent, and nearly equal to the amplitude of Peking, situated 10° more southerly and to that of Western Russia.

CHARTS OF ISOTHERMAL LINES.

The isothermal charts of Dove, being defective in those parts, which relate to Eastern Asia, and incorrect for the cold season, on account of insufficiency of observations at that time (1854), I have not compared with the materials procured by me; but have constructed new charts of Isothermal Lines, based upon the observations (128) and (129). Among the 43 stations of the tables (128) and (129) there are only seven of considerable height over the sea-level, namely, Yakutsk, Urga, Nerchink, Blagoveshchensk, Si-wan-tse, Kalgan and Peking.

The other 36 places are located almost on the sea-level itself, and consequently, the reduction to the sea-level is insignificant.

Supposing with Dove, that the temperature decreases, 1° Celsius if the height increases to 183 metres, the reductions of the observed monthly means of temperature of the fore-mentioned seven places to the sea-level will be as follows:

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	Reductions.
Yakutsk	+0.°5
Urga	+6. 3
Nerchinsk	+3. 3
Blagoveshchensk	+0. 6
Si-wan-tse	+6 6
Kalgan	+4. 5
Peking	+0. 2

The mean difference between the isothermal charts for January and December, and the observations (128) and (129), partly reduced to the sea-level by the help of (132), is ±0.°86 Celsius; but the difference between the chart, representing the annual mean temperature is only ±0.°46 Celsius. Let us now particularly investigate the Isothermal Lines for the mean annual temperature.

Comparing our chart of mean annual temperature with the chart of Isothermal Lines of mean annual temperature of North-America, published by Dove 1864, we find, that the Isothermal Line of the freezing point (0° Celsius) has almost the same shape in Eastern North-America, as in Eastern Asia, and that in both countries the parallel 50° is the most southern point, which this line has ever reached.

The Isothermal Lines between the parallels 55° and 40° run, in relation to these circles and to the land and water, similarly in those in Eastern Asia, to those in North-America; with the difference, that in North-America—in consequence of the great number of inland seas—the most southern points of the Isothermal Lines lie more to the West or more in the interior of the continent, than in Asia; where these points are situated very near to the coast of the ocean. The increase of the temperature from the parallel 55° to 40° is in America about 12°; in Eastern Asia almost the same. Though the winter in the 'Amoor-Territory' is relatively the severest on the whole globe, much more so than the winter of North-America on the same latitudes, the mean annual temperature of both continents is nearly the same, in consequence of the extraordinarily warm summer of Eastern Asia; so that the Isothermal Lines for the year between the parallels 55° and 40° nearly coincide. We must except only the land near the southern coast of the Amoor-Territory—the Ussuri-Territory—whose winter is extraordinary severe, partaking from the N.W., W. and N. winds of the great coldness of the continental interior of Asia; but whose summer, owing to the adjoining relatively cold sea of Japan (Liman-stream), is less warm than the summer of the western continent.

Also between the parallels 40° and 30° the form of the Isothermal Lines in the Eastern Asia resembles much their configuration in North-America. Within those limits and even further to the South, the isothermal lines already trend to the North, not only in the Continent, but in the immediately adjoining ocean; in America on account of the warm Gulf-stream, in Asia, owing to the Equatorial-stream and its branches. On the parallel of 40° we encounter in both countries the Isothermal Line 10°, but in North-eastern America the temperature, through the influence of the Gulf of Mexico, increases more rapidly in the direction of the South as far as the parallel 30°, than on the continent of Eastern Asia; especially in Northern China, where the influence of the warm oceanic currents is insignificant.

Within Eastern North-America the temperature increases between the parallels 55° and 40°, 0.°8 Celsius for every degree of decrease of latitude; and from the parallel 40° to the Gulf of

Mexico, where we encounter the Isothermal Line 21°, the temperature increases 1° Celsius as the latitude decreases 1°. In Northern China—between the latitudes 40° and 30°—the variation of the temperature for 10° variation of the latitude is only 5° Celsius; thus the temperature increases only 0.°5 for 1° decrease of latitude.

Hence Eastern North-America experiences, on all parallels from 55° to 40°, almost the same annual mean temperature, as the continent of Eastern Asia; but between the parallels 40° and 30°, America, on account of the Gulf of Mexico, is between 0 and 6 degrees warmer than Asia (Northern China).

On the Japanese Islands, between the parallels 45° and 30°, the temperature increases in consequence of the warm and cold currents, directed from S.W. to N.E., and *vice versâ* about 1° Celsius for the decrease of latitude 1°, or just as quickly as on the continent of Eastern America, and less so than on the ocean, at a distance from the American continent of some 10 degrees of longitude. During *January* Eastern Asia is everywhere colder than North-America on the same latitude.

In North-America the most southern positions of the Isothermal Lines in January are placed, exactly as the Isothermal Lines of mean annual temperature, much more westerly, *i.e.* in the interior of the continent than in Eastern Asia, where they in some places pass over the coast and touch the sea of Japan.

Between N. and S. the contrast in Eastern Asia is a little greater than in Eastern North-America, because the temperature between the parallels 55° and 30° in North America varies from 21° to 13°, but in Eastern Asia from 33° to 4°. Therefore, on an average, during January the continent of Eastern Asia is everywhere, between the latitudes 55° and 30°, more than ten degrees Celsius, in regard to the mean temperature, cooler than Eastern North America on the same latitudes!

As I have stated in the chapter on the absolute monthly and annual Maxima and Minima of the temperature, the cause of this contrast between Eastern Asia and Eastern North America is, on the one side the vast and dry continent of Asia, with a clear sky and great radiation, and the N., N.W. and W. winds of the winter, bringing the cold of Central Asia to Eastern Asia; and on the other side the not very great extension of North America, whose eastern part is surrounded with immense masses of water on three sides, distant in N.S. direction only about 10 degrees of latitude.

In accordance with the same circumstances, which produce a very severe winter in Eastern Asia and a less severe winter in Eastern North America, we learn by our charts of Isothermal Lines, that

the summer of Asia, especially of China and the interior of the Amoor-Territory is warmer than the summer of America.

Thus in the interior of the Amoor-Territory, on the parallel 55° we have the Isothermal Line for July of 19° Celsius, and on the frontier between northern and southern China, on the parallel 30° the Isothermal Line for July of 28° Celsius, but in North America, on the corresponding parallels the Isothermal Lines for July resp. of 11° C. and 28° C. Hence, near the latitude 30° both continents have in July the same temperature, in higher latitudes Asia is warmer than America, excepting the southern coast of the Amoor-Territory—the Ussuri Territory,—being a very little cooler than the corresponding coast of America.

The eastern part of North and Middle Asia, therefore, in what relates to the mean summer temperature, a most important factor for animal and vegetable life, is in a more favourable position than North America: in Siberia, in high latitudes as *e.g.* above 60°, exist towns (such as Yukutsk), but in North America we find only wildernesses.

The distribution of the temperature during January, April, July and October—the representatives of the four seasons is shown by the 15 tables (133)—(147), derived from our charts of Isothermal Lines. According to table (133) the annual mean temperature in the Amoor-Territory (latitudes 55°—40°) decreases from west to east, beginning from the meridian of 110°; reaches near the coast, between the meridians 125° and 130° a Minimum; afterwards increases and on Saghalin and Yesso, opposite to the continental part of the Amoor-Territory, almost the same temperature as on the continent in the meridian 115° appears again. Yesso and Saghalin, situated northerly from Nipon, have nearly the same annual mean temperature as the opposite continent; but Southern Japan, especially the southern and south-eastern coasts of Nipon, and the islands Kiusiu and Sikok are about two degrees warmer than the opposite part of China.

This is evidently an effect of the warm currents, called the Tsusima and Kurosiwo, which surround these islands on the S., W. and E., and of the cold current, washing the coast of northern China, running from N. to S. Again Southern China, included by the parallels 30° and 20°, is some degrees cooler than the adjacent ocean and islands. More to the S., a tropical sea-climate rules, and the Isothermal Lines between the latitudes 10° and 20° are parallel to the parallel circles.

The correctness of these statements proves our table (134), containing the variation of the mean annual temperature in the direc. tion from W. to E., as the longitude increases by increments of 5°-

Within the Amoor-Territory (between the latitudes 55° and 40°), and the most northern part of China as far as the parallel 35°, between the meridians 110° and 130°, these variations are negative and almost all less than 1° Celsius; further on, in the direction of the sea, they become positive, *i.e.* the contrast between W. and E. in the Amoor-Territory, and the most northern part of China is very insignificant.

For the latitudes between 30° and 20° the above-mentioned variations (134) are everywhere positive and reach their Maximum on the parallel 30°, where the difference of the annual mean temperature between China and the air over the sea of southern Japan is equal to about 6°; so that in the direction from W. to E. an increase of 1° in longitude is equivalent to an increase of temperature equal one-third degree Celcius.

To the S. this increase of temperature from W. to E. diminishes and beyond the parallel 20° it is about zero.

The increase of the annual mean temperature in the direction from N. to S. for a decrease of 5° degree in latitude is expressed in numbers by the table (135). It is evident, that the variation of the temperature with the latitude on an average in the Amoor-Territory, is greater than in China and on the islands of Eastern Asia.

On the middle of the Amoor-Territory, on the latitude 47.°5 the variation is smaller than on the northern and southern frontier. Near the frontier between China and Amoor-Territory, and between Northern and Southern Japan the variation reaches its absolute Maximum for Eastern Asia. The temperature near the parallel of 42.°5 increasing 1⅓ degree Celsius for 1 degree decrease of latitude. In the middle of the "Amoor-Territory this quantity is only 0.°6 Celsius, in North China 0.°4 Celsius, in South China 0.°7 C., and in Japan 1.°2 C. Therefore the variation of the annual mean temperature for variation of latitude is smallest in Northern China, situated between the parallels 40° and 30°; the whole variation of the temperature within this district of 10° latitude being only 4° Celsius.

Within Southern China, extending from the latitude 30° to 20°, the temperature increases from N. to S. more rapidly, namely, 7° Celsius.

The most northern parallel of China (latitude 40°) corresponds with the Isothermal Line of annual mean temperature 12° Celsius, the most southern parallel (20°) with that of 22° Celsius, therefore the mean annual temperature in China increases generally ½° Celsius, as the latitude decreases 1°.

This law would hold universally without exception, if all China coincided with the sea-level.

In reality Northern and Southern China differ, as far as relates to the mean annual temperature, much less than represented on our chart. For, as I have stated in the introduction, Southern China is composed of highlands, whose height over the sea-level is some 900 metres, but Northern China consists in low plains. The real annual mean temperature of the mass of Southern China must be 4–5 degrees lower than the temperature of our chart of mean annual temperature, constructed for the sea-level itself.

Therefore we will have—

In Northern China, on the latitude	40°	the real	annual	mean	temperature	12°
Near the southern frontier of Northern China, on the latitude	30°	„	„	„	„	15°
Near the northern frontier of the highland of Southern China, on the latitude	28°	„	„	„	„	12°
Near the southern frontier of the highland of Southern China, on the latitude	20°	„	„	„	„	17°

Hence, the annual mean temperature of Northern China, between 40° and 30° of latitude is $\frac{12+15}{2}=13.°5$; the annual mean temperature of Southern China $\frac{12+17}{2}=14.°5$.

These masses of land differ thus only 1° Celsius from each other! Therefore the Isothermal Lines of mean temperature are closest near the frontier between the Amoor-Territory and China, nearly as close in Japan and least close in China. Here evidently appears the influence of the different currents in the Pacific Ocean, explained in the introduction. The coasts of Japan are surrounded on the W. and S. by two southern warm water currents, the Tsusima stream and Kurosiwo, and on the N. and E. sides by the cold current, coming from the Kurile islands from the N. The warm, southern currents press Isothermal Lines of high temperature to the North, but the cold currents running from North to South press the Isothermal Lines of low temperature to the S.; the continental N., N.W. and W. winds, prevailing during the year, as shown on chart, have the same effect upon the Isothermal Lines of mean annual temperature. Consequently in Japan the Isothermal Lines of annual mean temperature are close, *i.e.* the temperature increases rapidly in the direction from N. to S. and most rapidly at those points, where cold currents meet warm currents.

The rapid increase of the temperature in the direction from N. to S. and N.W. to S.E. on the southern and eastern frontier of the Amoor-Territory, and China is produced in a similar manner.

The cold Liman current, washing the Amoor-Territory as far as the southern end of the eastern coast of Corea, brings the cold of the North to the South and transposes the Isothermal Lines in the same direction.

The rough mountain land of Corea has the same effect, augmenting considerably by radiation in the winter the cold, produced by the continent, Asia, and brought to Corea by the N., N.W. and W. winds.

In this manner the annual warmth is diminished on the eastern and south-eastern frontier of the Amoor-Territory (Ussuri-Territory and Corea), because the summer, owing to the neighbourhood of the cool sea, does not afford a sufficient compensation.

More westerly, near the S.W. and W. coast of Corea, on the northern frontier of the Gulf of Petchili, and of northern China on the parallel 40°, the climatological limit between the Amoor-Territory and China is determined partly by the warm current, which washes the W. coast of Corea, enters the Gulf of Petchili, and in this manner carries southern Isothermal Lines to the N., partly by the winterly coldness, produced in the northern parts of the Amoor-Territory, transported by N. and N.W. winds to the S. and pushing the Isothermal Lines of low temperature to the S. and S.E. That the annual mean temperature in the whole of China varies only some degrees, is not only the consequence of the highland character of Southern China, making it cooler, but partly also owing to the currents in the adjacent seas, equalising the differences of temperature.

Thus the most western branch of the Equatorial current warms the western coast of Corea and the Gulf of Petchili. Here the water, after losing its high temperature, returns cold along the coast of Northern China to the South. To this circumstance is also due the fact, that the most northern part of China has in winter a mild climate in relation to the severe climate of the neighbouring "Amoor-Territory."

The effect of the currents of the Pacific Ocean on the temperature of the air on Eastern Asia is illustrated most clearly by the Isothermal Lines for January.

The shape of the Isothermal Lines for January, the best representatives of the cold season, resembles much the Isothermal Lines for the year.

Northerly from the parallel 35° they fall to the South, as we

start from the meridian 100° to the East; and reach their most southern point near the coast, where they suddenly trend to the North.

Between the parallel 35° and 20° the Isothermal Lines of January on the continent and on the adjacent ocean, have the direction W.S.W. to E.N.E.; and finally, to the south of the parallel of 20° the Isothermal Lines are nearly parallel to the circles of latitude.

According to our isothermal charts the variation of the temperature with the geographical position in January is (longitude and latitude) greater than in any other month.

The numerical values of this great variation of the temperature in the direction of the parallels and meridians are contained in the tables (136), (137) and (138), derived by means of the chart of Isothermal Lines for January.

Between the latitudes 55° and 35° the temperature of January decreases from the longitude 100° to 126°, afterwards it increases very much in the direction to the East.

The island of Saghalin is on its western coast, to the north of 50° latitude, about two degrees warmer than the opposite continent. This difference of the coasts of the sea of Japan on the same latitudes increases, beginning from the parallel 50°, to the South. At Vladivostok, compared with the corresponding coast of Yesso it is equal to 8° Celsius; on the parallel 40°, where the sea of Japan is most extended from W. to E., it reaches its Maximum, 10° C.

Afterwards, more to the South, this difference decreases, because the sea of Japan becomes smaller; and on the southern end of Corea, where the Line of 0° Celsius passes, it is only 2° Celsius. The eastern coasts of Saghalin and Yesso are in January some 2—3 degrees warmer than the western coasts; but the southern and south-eastern coast of Nipon 4—6 degrees warmer than its northern and western coast, on the same latitude.

The Isothermal Lines of January on the seas and islands of Eastern Asia have very often the same direction as the sea currents, the direction of the Kurosiwo, of the Tsusima and Liman currents, indicating especially the course of the Isothermal Lines.

The cold N.W. wind, coming from the cold continent and overflowing the sea and the islands, blows at right angles to these Isothermal Lines, and to the direction of the before-mentioned water currents. Passing therefore very soon, after having run through a short distance, from the cold Liman current to the warm Tsusima and Kurosiwo current, the N.W. becomes suddenly warm. Consequently near the frontier between the cold Liman and warm

Tsusima current the Isothermal Lines are most close and form the S.E., limit of the so-called Amoor-Territory.

There the temperature increases $2\frac{1}{2}$ Celsius, as the latitude decreases 1°, or more than 2 Celsius in 100 kilometres [cf. table (138), longitude 130°, latitude 37.°5].

The Isothermal Line of zero in January descends, on the meridian of Corea, to the parallel of 35°, which proves, that besides the continental N., N.W. and W. winds, the considerable land-mass of Corea gives also a perceptible contribution to the coldness of Eastern Asia during the winter.

The temperature of Northern China also in January, as in all other seasons, varies in the direction from N. to S. much less than in any other country of Eastern Asia.

Southern China, considered as a whole, differs very little from Northern China in relation to the temperature, but its Isothermal Lines are—on account of the warm southern sea of China—during all seasons more close than in Northern China.

The Isothermal Lines of January resemble, with few deviations, those of the other cold months of the year: November, December, February and March (See Charts).

During these cold months the sea is warmer than the continent and the islands.

As, in spring, the sun ascends to the north and its height in the northern hemisphere increases, the dry land becomes warm sooner than the ocean. Consequently in spring, the temperature of the air over the land approaches that of the air over the sea, and the Isothermal Lines of April are nearly parallel to the parallel circles.

In May, the temperature of the air over the continent, situated to the south of the parallel 30°, is nearly equal to that of the air over the sea on the same latitudes; north of that parallel, 30°, the air of the continent is much warmer than that of the islands and ocean. The same law holds good during June, July and August, only with the exception, that in Ussuri-Territory, near the meridian of 130°, on the land, the Isothermal Lines begin to descend rapidly to the S.; and consequently, that the Ussuri-Territory and the mouth of the Amoor river, subjected, as is the whole of Eastern Asia, to a severe winter, have no part in the extraordinary high summer temperature of the Asiatic continent.

In July, representing the summer, all the differences of table (143) are negative; and in the N. its absolute value is greater than in the S., where it equals zero: *i.e.* the East is on all longitudes, northerly from the latitude 25°, cooler than the West. During

January, table (137), these differences, within the N.W. part of the district under review, are negative: and within the E. and S.E. part of our district under review positive. On an average these differences of January are numerically greater than those of July.

In April table (140), and October, table (146), these differences are numerically smallest: *i.e.* the W. differs least from the E. The variation of the temperature in the direction N. and S., is in January at its Maximum and in July at its Minimum; but during the whole year it is positive, *i.e.* the temperature increases everywhere and at every time of the year, as the latitude decreases. As the latitude decreases 1°, the temperature increases:

in January	in Minimo......0.°6,	in Maximo......2.°4,	therefore in Medio......1.°5
in April	,, ...0. 1,	,, ...2. 4,	,, ,, ...0. 7
in July	,, ...0. 0,	,, ...0. 8,	,, ,, ...0. 4
in October	,, ...0. 2,	,, ...1. 4,	,, ,, ...0. 8

The Isothermal Lines of July are, therefore, in Eastern Asia, almost four times more distant from each other than in January.

133 ISOTHERMAL LINES OF MEAN ANNUAL TEMPERATURE.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	55.°0	—3. 5	—4. 0	—4. 7	—4. 9	—4. 8	—4. 1	—3. 3	—2. 5
	50. 0	+1. 6	1. 0	0. 5	0. 2	0. 1	0. 3	0. 9	1. 7
	45. 0	+4. 8	4. 0	3. 5	3. 2	2. 9	3. 0	3. 5	5. 0
	40. 0	+12. 1	11. 6	10. 2	9. 2	8. 8	9. 2	10. 4	11. 9
	35. 0	13. 7	13. 7	13. 7	13. 8	14. 0	14. 9	16. 4	18. 0
	30. 0	15. 4	15. 6	16. 0	17. 3	18. 9	21. 0	22. 5	23. 0
	25. 0	19. 0	20. 1	21. 3	22. 4	22. 8	23. 0	......	......
	20. 0	22. 9	23. 2	23. 9	24. 2	24. 5	......	......	......

ISOTHERMAL LINES OF MEAN ANNUAL TEMPERATURE,—(*Continued.*)

134 Variation of Mean Annual Temperature, as the Longitude increases 5 degrees.

Longitude	=	112.°5	117.°5	122.°5	127.°5	132.°5	137.°5	142.°5
Latitude	55.°0	—0. 5	—0. 7	—0. 2	+0. 1	+0. 7	+0. 8	+0. 8
	50. 0	—0. 6	—0. 5	—0. 3	—0. 1	+0. 2	+0. 6	+0. 8
	45. 0	—0. 8	—0. 5	—0. 3	—0. 3	+0. 1	+0. 5	+1. 5
	40. 0	—0. 5	—1. 4	—1. 0	—0. 4	+0. 4	+1. 2	+1. 5
	35. 0	0. 0	0. 0	+0. 1	+0. 2	+0. 9	+1. 5	+1. 6
	30. 0	+0. 2	+0. 4	+1. 3	+1. 6	+2. 1	+1. 5	+0. 5
	25. 0	+1. 1	+1. 2	+1. 1	+0. 4	+0. 2	......	......
	20. 0	+0. 3	+0. 7	+0. 3	+0. 3	......	......	......

135 Variation of Mean Annual Temperature, as the Latitude decreases 5 degrees.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	52.°5	+5. 1	+5. 0	+5. 2	+5. 1	+4. 9	+4. 4	+4. 2	+4. 2
	47. 5	+3. 2	+3. 0	+3. 0	+3. 0	+2. 8	+2. 7	+2. 6	+3. 3
	42. 5	+7. 3	+7. 6	+6. 7	+6. 0	+5. 9	+6. 2	+6. 9	+6. 9
	37. 5	+1. 6	+2. 1	+3. 5	+4. 6	+5. 2	+5. 7	+6. 0	+6. 1
	32. 5	+1. 7	+1. 9	+2. 3	+3. 5	+4. 9	+6. 1	+6. 1	5. 0
	27. 5	+3. 6	+4. 5	+5. 3	+5. 1	+3. 9	+2. 0	......	......
	22. 5	+3. 9	+3. 1	+2. 6	+1. 8	+1. 7	......	......	......

136 ISOTHERMAL LINES OF JANUARY.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	55.°0	—27. 0	—28. 3	—31. 5	—34. 5	—31. 0	—26. 0	—24. 2	—19. 0
	50. 0	—23. 8	—24. 3	—24. 9	—25. 6	—25. 3	—24. 2	—19. 2	—13. 0
	45. 0	—14. 6	—16. 0	—17. 2	—18. 0	—18. 2	—17. 3	—11. 0	—4. 0

ISOTHERMAL LINES OF JANUARY,—(*Continued.*)

Latitude	40.°0	—2.°4	—4.°3	—7.°2	—10.°6	—12.°1	—7.°0	—1.°9	2.°0
	35. 0	1. 6	1. 0	0. 8	0. 1	0. 0	3. 0	6. 0	......
	30. 0	4. 8	4. 3	4. 1	6. 0	9. 0	11. 6	16. 0	......
	25. 0	11. 0	12. 1	14. 8	16. 5	18. 0	......	......	......
	20. 0	17. 9	18. 7	19. 5	20. 6	21. 5	......	......	......

137 Variation of the Mean Monthly Temperature of January, as the Longitude increases 5 degrees.

Longitude	=	112.°5	117.°5	122.°5	127.°5	132.°5	137.°5	142.°5
Latitude	55.°0	—1. 3	—3. 2	—3. 0	+3. 5	+5. 0	+1. 8	+5. 2
	50. 0	—0. 5	—0. 6	—0. 7	+0. 3	+1. 1	+5. 0	+6. 2
	45. 0	—1. 4	—1. 2	—0. 8	—0. 2	+0. 9	+6. 3	+7. 0
	40. 0	—1. 9	—2. 9	—3. 4	—1. 5	+5. 1	+5. 1	+3. 9
	35. 0	—0. 6	—0. 2	—0. 7	—0. 1	+3. 0	+3. 0	......
	30. 0	—0. 5	—0. 2	+1. 9	+3. 0	+2. 6	+4. 4	......
	25. 0	+1. 1	+2. 7	+1. 7	+1. 5	......	......	......
	20. 0	+0. 8	+0. 8	+1. 1	+0. 9	......	......	......

138 Variation of the Mean Monthly Temperature of January, as the Latitude decreases 5 degrees.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	52.°5	+3. 2	+4. 0	+6. 6	+8. 9	+5. 7	+1. 8	+5. 0	+6. 0
	47. 5	+9. 2	+8. 3	+7. 7	+7. 6	+7. 1	+6. 9	+8. 2	+9. 0
	42. 5	+12. 2	+11. 7	+10. 0	+7. 4	+6. 1	+10. 3	+9. 1	+6. 0
	37. 5	+4. 0	+5. 3	+8. 0	+10. 7	+12. 1	+10. 0	+7. 9	......
	32. 5	+3. 2	+3. 3	+3. 3	+5. 9	+9. 0	+8. 6	+10. 0	......
	27. 5	+6. 2	+7. 8	+10. 7	+10. 5	+9. 0	......	......	......
	22. 5	+6. 9	+6. 6	+4. 7	+4. 1	+3. 5	......	......	......

139 **ISOTHERMAL LINES OF APRIL.**

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	55.°0	—0. 2	—1. 2	—2. 1	—2. 8	—3. 1	—3. 7	—3. 7	—3. 5
	50. 0	4. 7	4. 1	3. 2	2. 5	1. 9	1. 0	0. 7	0. 9
	45. 0	8. 3	7. 7	6. 6	5. 7	5. 2	4. 6	4. 4	4. 3
	40. 0	12. 3	12. 2	11. 6	10. 2	9. 1	8. 7	8. 5	8. 3
	35. 0	13. 1	13. 0	12. 9	12. 9	12. 9	13. 0	13. 2	14. 1
	30. 0	13. 8	13. 8	13. 9	14. 7	16. 0	17. 2	18. 0	......
	25. 0	18. 8	19. 0	19. 3	20. 7	22. 0	......	......	......
	20. 0	23. 8	24. 0	24. 2	24. 7	24. 7	......	......	......

140 Variation of the Mean Monthly Temperature of April, as the Longitude increases 5 degrees.

Longitude	=	112.°5	117.°5	122.°5	127.°5	132.°5	137.°5	142.°5
Latitude	55.°0	—1. 0	—0. 9	—0. 7	—0. 3	—0. 6	0. 0	+0. 2
	50. 0	—0. 6	—0. 9	—0. 7	—0. 6	—0. 9	—0. 3	+0. 2
	45. 0	—0. 5	—1. 1	—0. 9	—0. 5	—0. 6	—0. 2	—0. 1
	40. 0	—0. 1	—0. 6	—1. 4	—1. 1	—0. 4	—0. 2	—0. 2
	35. 0	—0. 1	—0. 1	0. 0	0. 0	+0. 1	+0. 2	+0. 9
	30. 0	0. 0	+0. 1	+0. 8	+1. 3	+1. 2	+0. 9	......
	25. 0	+0. 2	+0. 3	+1. 4	+1. 3	......	......	......
	20. 0	+0. 2	+0. 2	+0. 5	0. 0	......	......	......

141 Variation of the Mean Monthly Temperature of April, as the Latitude decreases 5 degrees.

Longittde	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	52.°5	+4. 9	+5. 3	+5. 3	+5. 3	+5. 0	+4. 7	+4. 4	+4. 4
	47. 5	+3. 6	+3. 6	+3. 4	+3. 2	+3. 3	+3. 4	+3. 7	+3. 4
	42. 5	+4. 0	+4. 5	+5. 0	+4. 5	+3. 9	+4. 1	+4. 1	+4. 0

ISOTHERMAL LINES OF APRIL,—(*Continued.*)

Latitude	37.°5	+0.°8	+0.°8	+1.°3	+2.°7	+3.°8	+4.°3	+4.°7	+5.°8
	32. 5	+0. 7	+0. 8	+1. 0	+1. 8	+3. 1	+4. 2	+4. 8	......
	27. 5	+5. 0	+5. 2	+5. 4	+6. 0	+6. 0	......	......	......
	22. 5	+5. 0	+5. 0	+4. 9	+4. 0	+2. 7	......	......	......

142 ISOTHERMAL LINES OF JULY.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	55.°0	20. 0	19. 9	19. 6	19. 0	18. 3	16. 6	14. 8	13. 0
	50. 0	22. 4	22. 1	21. 9	21. 3	20. 7	19. 5	17. 0	13. 0
	45. 0	24. 7	24. 3	23. 8	23. 0	21. 0	19. 5	17. 8	17. 0
	40. 0	26. 7	26. 3	25. 9	24. 7	22. 0	21. 0	20. 3	20. 4
	35. 0	27. 9	27. 7	27. 2	26. 5	25. 5	24. 9	24. 3	24. 2
	30. 0	28. 0	28. 0	28. 0	27. 8	27. 0	26. 4	......	......
	25. 0	28. 0	28. 0	28. 0	28. 0	......	......	......	......
	20. 0	27. 8	27. 8	27. 8	27. 9	......	......	......	......

143 Variation of the Mean Monthly Temperature of July, as the Longitude increases 5 degrees.

Longitude	=	112.°5	117.°5	122.°5	127.°5	132.°5	137.°5	142.°5	......
Latitude	55.°0	—0. 1	—0. 3	—0. 6	—0. 7	—1. 7	—1. 8	—1. 8	......
	50. 0	—0. 3	—0. 2	—0. 6	—0. 6	—1. 2	—2. 5	—4. 0	......
	45. 0	—0. 4	—0. 5	—0. 8	—2. 0	—1. 5	—1. 7	—0. 8	......
	40. 0	—0. 4	—0. 4	—1. 2	—2. 7	—1. 0	—0. 7	+0. 1	......
	35. 0	—0. 2	—0. 5	—0. 7	—1. 0	—0. 6	—0. 6	—0. 1	......
	30. 0	0. 0	0. 0	—0. 2	—0. 8	—0. 6	......	......	......
	25. 0	0. 0	0. 0	0. 0	......	......	......	......	......
	20. 0	0. 0	0. 0	+0. 1	......	......	......	......	......

ISOTHERMAL LINES OF JULY,—(*Continued.*)

144 Variation of the Mean Monthly Temperature of July, as the Latitude decreases 5 degrees.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	52.°5	+2. 4	+2. 2	+2. 3	+2. 3	+2. 4	+2. 9	+2. 2	+0. 0
	47. 5	+2. 3	+2. 2	+1. 9	+1. 7	+0. 3	0. 0	+0. 8	+4. 0
	42. 5	+2. 0	+2. 0	+2. 1	+1. 7	+1. 0	+1. 5	+2. 5	+3. 4
	37. 5	+1. 2	+1. 4	+1. 3	+1. 8	+3. 5	+3. 9	+4. 0	+3. 8
	32. 5	+0. 1	+0. 3	+0. 8	+1. 3	+1. 5	+1. 5	......	......
	27. 5	0. 0	0. 0	0. 0	+0. 2	......	......	......	......
	22. 5	—0. 2	—0. 2	—0. 2	—0. 1	......	......	......	......

ISOTHERMAL LINES OF OCTOBER.

145

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	55.°0	—0. 9	—0. 9	—0. 8	—0. 8	—0. 7	—0. 5	—0. 2	0. 4
	50. 0	2. 5	2. 7	2. 9	3. 1	3. 6	4. 1	4. 8	5. 4
	45. 0	7. 0	6. 9	7. 0	7. 2	7. 2	7. 7	8. 0	8. 3
	40. 0	12. 3	12. 1	12. 0	12. 0	12. 0	12. 0	12. 1	12. 2
	35. 0	16. 2	16. 3	16. 4	16. 5	16. 8	17. 0	18. 0	19. 5
	30. 0	17. 5	17. 7	18. 0	19. 4	21. 0	22. 7	......	......
	25. 0	21. 2	22. 2	23. 4	24. 2	24. 5	......	......	......
	20. 0	24. 5	24. 9	25. 1	......	......	......	......	......

146 Variation of the Mean Monthly Temperature of October, as the Longitude increases 5 degrees.

Longitude	=	112.°5	117.°5	122.°5	127.°5	132.°5	137.°5	142.°5	......
Latitude	55.°0	0. 0	+0. 1	0. 0	+0. 1	+0. 2	+0. 3	+0. 6	......
	50. 0	+0. 2	+0. 2	+0. 2	+0. 5	+0. 5	+0. 7	+0. 6	......

ISOTHERMAL LINES OF OCTOBER,—(*Continued.*)

Latitude	45.°0	—0.°1	+0.°1	+0.°2	0.°0	+0.°5	+0.°3	+0.°3	......
	40. 0	—0. 2	—0. 1	0. 0	0. 0	0. 0	+0. 1	+0. 1	......
	35. 0	+0. 1	+0. 1	+0. 1	+0. 3	+0. 2	+1. 0	+1. 5	......
	30. 0	+0. 2	+0. 3	+1. 4	+1. 6	+1. 7	......	......	......
	25. 0	+1. 0	+1. 2	+0. 8	+0. 3	......	......	......	......
	20. 5	+0. 4	+0. 1	......	......	......	......	......	......

147 Variation of the Mean Monthly Temperature of October, as the Latitude decreases 5 degrees.

Longitude	=	110.°0	115.°0	120.°0	125.°0	130.°0	135.°0	140.°0	145.°0
Latitude	52.°5	+3. 4	+3. 6	+3. 7	+3. 9	+4. 3	+4. 6	+5. 0	+5. 0
	47. 5	+4. 5	+4. 2	+4. 1	+4. 1	+3. 6	+3. 6	+3. 2	+2. 9
	42. 5	+5. 3	+5. 2	+5. 0	+4. 8	+4. 8	+4. 3	+4. 1	+3. 9
	37. 5	+3. 9	+4. 2	+4. 4	+4. 5	+4. 8	+5. 0	+5. 9	+7. 3
	32. 5	+1. 3	+1. 4	+1. 6	+2. 9	+4. 2	+5. 7	......	......
	27. 5	+3. 7	+4. 5	+5. 4	+4. 8	+3. 5	......	......	......
	22. 5	+3. 3	+2. 7	+1. 7	......	......	......	......	......

I will now make a comparison between the temperature of the water of the ocean on the surface and the temperature of the air, resting upon the water on the same place. In composing the following table (148) I have supposed, that the temperature of the water of the cold streams in the seas of Japan and Okhotsk is in winter equal to 0° Celsius, and have distinguished these temperatures 0° and the numbers, deduced by its help, by asterisks.

WARM CURRENTS.

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			Temperatures of						
			Summer.		Winter.		Differences between Water and Air.		Mean of Differ. between Water and Air.
	Longitude.	Latitude.	Water.	Air.	Water.	Air.	Summer.	Winter.	
Kuro-siwo	124°	27°	31°	28°	21°	12°	+3°	+9°	+6.°0
,,	138	32	30	26	19	12	+4	+7	+5. 5
,,	145	37	...	...	16	6	...	+10	...
,,	155	44	13	20	...	...	—7	...	...
Goto Islands, Tsusima-current	129	33	28	27	16	2	+1	+14	+7. 5
Near Hakodate ,,	139	41	24	22	10	—2	+2	+12	+7. 0
Laperouse Strait ,,	142	46	17	19	...	...	—2	...	...
Sea of Okhotsk ,,	146	47	14	19	...	...	—5	...	...
W. Coast of Saghalin ,,	141. 5	47	16	18. 5	...	...	—2. 5	...	...

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COLD CURRENTS.

	Longitude.	Latitude.	Summer Water.	Summer Air.	Winter Water.	Winter Air.	Diff. Summer.	Diff. Winter.	Mean of Differ.
Near Formosa	121°	27°	26°	25.°5	15°	11°	+0.°5	+4	+2.°2
Limanian-stream	131	41	18	21	*0	—8	—3	+8*	—2. 5*
,, ,,	141. 5	50	15	12	*0	—15	+3	+15*	+9. 0*
Kurilian-stream	156	52	11. 5	15	*0	—8	—3. 5	+8*	+2. 2*
,, ,,	152	49	6	16	*0	—3	—10	+3*	—3. 5*
Sea of Okhotsk, mean of numbers	...	...	11. 5	15	*0	—13	—3. 5	+13*	+4. 7*

Consequently in *winter* the water of the sea is everywhere about 10 degrees warmer than the air resting upon it,—the water of the warm currents as well as that of the cold currents in all latitudes.

In *summer* in the northern parts of the seas, bordering on Eastern Asia, as far as the latitude of about 42°, the water is about 3 degrees cooler than the air; but in lower latitudes during the summer the water is 2—3 degrees warmer than the air.

THERMAL ANOMALIES.—TABLE (150).

CONTINENT OF EASTERN ASIA.

	Jan.	Feb.	Mar.	Apr.	May.	June.
Yahutsk	—22.°4	—18.°9	—11.°4	—4.°7	—0.°1	+4.°2
Okhutsk	—9. 2	—9. 9	—5. 6	—5. 1	—3. 4	—2. 8
Ayan	—8. 3	—4. 8	—4. 3	—5. 4	—5. 6	—4. 6
Udskoi	—16. 7	—16. 5	—6. 5	—4. 5	—4. 5	+0. 3
Nikolajevsk	—15. 0	—13. 4	—10. 6	—7. 1	—5. 5	—1. 5
Mariinsk	—13. 2	—11. 3	—8. 4	—4. 9	—3. 0	+1. 0
Urga	—17. 0	—12. 6	—5. 2	+0. 1	+2. 6	+4. 6
Nerchinsk	—18. 0	—14. 3	—6. 7	—2. 3	+1. 3	+4. 3
Blagoveshchensk	—18. 9	—14. 5	—7. 8	—2. 2	+1. 1	+3. 3
Imperial Harbour	—13. 8	—15. 3	—14. 9	......	......	......
Olga Bay	—12. 4	—10. 1	—5. 7	—5. 3	......	......
Vladivostok	—17. 1	—13. 1	—6. 8	—7. 0	—6. 2	—4. 8
Possjet Bay	—17. 2	—13. 2	—5. 5	—5. 5	—5. 7	—3. 4
Si-wan-tse	—13. 6	—9. 5	—3. 4	—2. 2	+2. 4	+4. 0
Kalgan	—10. 2	—8. 5	......	......	......	......
Newchwang	—15. 7	—12. 2	—7. 3	—3. 6	—0. 5	+2. 4
Peking	—9. 0	—6. 7	—2. 7	+1. 3	+3. 4	+4. 5
Tientsin	—7. 8	—6. 2	—2. 9	—0. 3	+1. 8	+3. 7
Taku	—10. 3	—8. 8	—4. 6	—1. 7	+1. 4	+3. 1

THERMAL ANOMALIES.—(*Continued*).

	Jan.	Feb.	Mar.	Apr.	May.	June.	
Chefoo	—8.°5	......	......	......	......	......	
Shanghai	—10. 1	—10.°0	—8.°1	—6.°2	—3.°8	—1.°8	
Fu-cheu-foo	......	......	......	—4. 8	—4. 4	+1. 6	
Canton	—6. 8	—8. 4	—4. 1	—3. 4	+1. 9	+1. 3	
Saigon	+0. 8	+0. 8	+1. 2	+1. 6	+0. 9	+0. 1	
Bangkok	+1. 2	+0. 3	+2. 1	+1. 2	+0. 7	+0. 5	
	July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	
Yahutsk	+5.°4	+4.°0	—0.°7	—7.°4	—17.°7	—22.°8	—7.°7
Okhutsk	—0. 6	+1. 8	+0. 9	—4. 4	—7. 2	—10. 4	—4. 7
Ayan	—2. 1	—1. 0	—0. 9	—4. 9	—6. 7	—8. 9	—4. 8
Udskoi	+0. 7	+1. 1	+1. 1	—5. 4	—13. 8	—21. 0	—7. 1
Nikolajevsk	+0. 2	+0. 8	—0. 7	—3. 1	—7. 8	—12. 9	—6. 4
Mariinsk	+3. 0	+3. 4	+1. 6	—0. 8	—5. 7	—11. 0	—4. 7
Urga	+5. 8	+3. 5	+2. 2	—3. 6	—2. 6	—13. 9	—3. 6
Nerchinsk	+4. 7	+2. 9	—0. 1	—4. 6	—12. 1	—17. 7	—5. 2
Blagoveshchensk	+5. 8	+4. 9	+1. 1	—3. 4	—12. 2	—19. 1	—5. 2
Imperial Harbour	—0. 5	—0. 1	—0. 9	—4. 5	—10. 2	—9. 1	......
Olga Bay	......	......	......	......	......	—11. 7	......
Vladivostok	—2. 0	—0. 8	—1. 6	—4. 1	—8. 2	—13. 4	—7. 3
Possjet Bay	—1. 6	+2. 0	......	......	......	—13. 0	......
Si-wan-tse	+4. 2	+1. 7	—0. 1	—4. 0	—9. 0	—10. 2	—3. 3
Kalgan	......	+5. 5	+3. 9	—2. 2	—6. 3	—9. 6	......
Newchwang	+3. 4	+2. 0	+0. 3	—4. 4	—5. 9	—12. 5	—4. 5

THERMAL ANOMALIES.—(*Continued*).

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
Peking	+3.°9	+2.°3	+1.°6	—2.°7	—5.°7	—8.°4	—1.°5
Tientsin	+4. 4	+2. 7	+2. 8	—1. 5	—5. 9	—7. 2	—1. 4
Taku	+4. 4	+3. 0	+1. 3	—3. 3	—6. 6	—9. 7	—2. 6
Chefoo	+3. 1	+1. 2	+0. 8	—1. 9	—5. 8	—4. 9	......
Shanghai	+2. 8	+0. 5	—1. 5	—4. 6	—7. 0	—8. 6	—4. 9
Fu-cheu-foo	+1. 7	+0. 1	—0. 9	—1. 9	—4. 5	—4. 9	......
Canton	+0. 6	—0. 7	—1. 0	—3. 2	—6. 3	—8. 3	—3. 5
Saigon	+0. 1	—0. 6	—0. 5	+0. 4	0. 0	+1. 1	+0. 5
Bangkok	+0. 2	+0. 1	—0. 1	+0. 2	—0. 6	—0. 6	+0. 4

ISLANDS OF EASTERN ASIA.—TABLE (151).

	Jan.	Feb.	Mar.	Apr.	May.	June.
Petropaulovsk	+1.°3	—1.°7	—1.°0	—4.°6	—4.°9	—3.°5
Dui	—7. 4	—7. 8	—5. 7	—4. 4	—4. 6	—3. 6
Kussunai	—8. 6	—9. 0	—6. 4	—5. 8	—5. 5	—5. 5
Aniva Bay	—7. 1	—8. 9	—5. 5	—4. 2	—5. 7	......
Hakodate	—5. 3	—5. 1	—4. 7	—4. 6	—4. 3	—4. 1
Niigata	—6. 7	—7. 5	—5. 3	—3. 1	—2. 1	—0. 9
Yokohama	—5. 4	—5. 3	—4. 5	—2. 9	—2. 3	—1. 9
Osaka	—6. 5	—4. 9	—4. 0	—3. 1	—2. 9	—0. 4
Decima	—6. 5	—6. 5	—5. 6	—3. 5	—2. 9	—2. 1
Nafa	—1. 2	—2. 6	—2. 3	—2. 0	—0. 5	+0. 4
Kelung	—4. 0	—4. 6	—4. 7	—4. 5	—1. 8	+1. 3

THERMAL ANOMALIES.—(*Continued*).

	Jan.	Feb.	Mar.	Apr.	May.	June.	
Victoria	—4.°6	—5.°8	—4.°5	—2.°1	—0.°2	+1.°2	
Macao	—3. 2	—7. 8	—4. 8	—3. 2	—1. 2	+1. 1	
Manila	+0. 5	+0. 3	+0. 2	0. 0	+0. 5	+0. 1	
	July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	
Petropaulovsk	—1.°4	0.°0	0.°0	—0.°1	+1.°0	+1.°6	—1.°1
Dui	—2. 0	+0. 6	—0. 2	—0. 9	—4. 6	—8. 1	—4. 1
Kussunai	—3. 2	+1. 5	—1. 1	—1. 6	—3. 6	—6. 5	—4. 6
Aniva Bay	......	......	......	......	—2. 7	—6. 4	......
Hakodate	—2. 4	—0. 1	+0. 4	—2. 2	—2. 6	—4. 3	—3. 2
Niigata	+2. 2	+3. 1	+2. 5	+0. 1	—1. 3	—4. 7	—2. 0
Yokohama	—0. 8	+0. 7	—0. 3	—2. 8	—3. 2	—4. 3	—2. 7
Osaka	+1. 5	+1. 8	+1. 8	—0. 8	—1. 5	—3. 7	—1. 9
Decima	+1. 3	+1. 3	+0. 5	—2. 8	—3. 9	—5. 4	—3. 0
Nafa	+2. 2	+0. 4	+1. 1	+1. 4	—0. 1	0. 0	—0. 8
Kelung	+1. 3	0. 0	0. 0	—1. 5	—3. 2	—2. 2	—2. 8
Victoria	+1. 5	+0. 5	0. 0	—1. 3	—3. 6	—4. 9	—2. 0
Macao	+0. 9	+0. 4	+0. 6	—1. 3	—4. 1	—5. 1	—2. 0
Manila	—0. 7	—0. 6	—0. 7	—0. 6	—0. 6	—0. 3	—0. 2

The Thermal Anomalies, Tables (150) and (151), I have calculated by means of the observations (128) and (129), of the reduction (132) and of the constant numbers, published by Dove in his work "Die Verbneitung der Warme und der Oberflache der Erde, erlautert durch Isothermen, Thermische Isanomalen und Temperaturcurven von H. W. Dove, 1852."

The lines of isabnormal temperature, as the Isothermal Lines, of Dove for Eastern Asia are very incomplete, and differ much from our tables (150) and (151), especially for the Southern Amoor-Territory during the cold season.

For example, according to the Charts of Dove, the Lines of Isabnormal Temperature in January, crossing the Amoor-Territory in the direction of S.S.W. to N.N.E. and passing by Vladivostok and Nikolajevsk indicate the anomaly —4° Réaumur or —5° Celsius; but our observations prove, that the right Thermal Anomalies, according to table (150), are respectively —15°0 and —17.°1 Celsius.

Just so the observed negative Thermal Anomalies of Japan in January are, table (151), some degrees greater than those of Dove's Chart.

At the highest northern limit (Yakutsk), and the lowest southern limit of the countries under review, (India beyond the Ganges and Philippine Islands), the error of Dove's Lines of Isabnormal Temperature of January is small.

Dove's Lines of Isabnormal Temperature of July accord within some degrees with the observed quantities (150) and (151).

We learn from these two tables, that the greatest part of Eastern Asia during about 8 months of the year (the cold season) is too cold in relation to the Latitude—and during the warm season (about 4 months, June—September) too hot; that moreover the absolute value of the positive anomalies in summer are smaller than the absolute value of the negative anomalies during the cool season; and that at last, in consquence of these two circumstances the whole of Eastern Asia, on an average for the year, is too cold, in regard to its latitude.

As tables (150) and (151) demonstrated, there are some parts of Ea-tern Asia, whose isothermal anomalies are negative (too cold) not only during the cool season (8 months), but the whole year. To this category belong: the Coasts of the sea of Okhotsk, of the Amoor-Territory, Saghalin and Yesso, which have no part in the extraordinarily hot summer of the Continent of Eastern Asia, because the cold water of the neighbouring seas, and the fog produced by S. and S.E. winds, make the confined land cold.

The rest of Eestern Asia, as far as the parallel of 15°0—the Amoor-Territory, China, Southern Japan and Formosa—have during the cool season negative, during the summer positive anomalies.

Nearer to the equator the thermal anomalies become very small.

In Europe, in contrast with the Cold Eastern Asia, the Thermal Anomalies during the whole year are positive: *i.e.* Europe is in all months too warm for its latitude.

In January these Anomalies of Europe vary, according to the Lines of Isabnormal Temperature, drawn by Dove, between 0 degrees Celsius (on the frontier between Europe and Asia) and +15 degrees Celsius (in Scotland and Scandinavia), and the Lines of Isabnormal Mean Monthly Temperature have nearly the direction S.W. to N.E. or that of the Gulf stream.

In July the whole of Europe is between 0° Celsius (near its most western frontier) and 5° Celsius (near its eastern and south eastern frontier) too warm.

Therefore, when comparing the Amoor-Territory in January with N.W. Europe,—for instance Great Britain, having nearly the same latitude, we find, that Europe is about 13° too warm, and at the same time the Amoor-Territory about 15° too cold, or a difference of 28° in the Mean Temperatnre.

In July this latter difference is very little.

Spain, situated nearly on the same latitude as northern China and Japan, is in July some degrees cooler than Northern China and Japan, but in winter about 12 degrees warmer.

The following tables (152) and (153) I have arranged, in order to compare the west coast of the old world with its eastern coast, in regard to the mean monthly temperature of the air on the same latitudes.

This comparison is interesting not only for itself, but for this reason, that the figures of tables (152) and (153) show plainly the great influence, which the distribution of the dry land and water (with its currents) over the globe has on the climate of the surface; and that next to the latitude of any place on the globe this distribution of land and water is the most important factor, in determining the temperature of the air.

Thus, in accordance with table (152), the difference A.—E. in January, on an average of our eight pairs of corresponding places, is—25° Celsius; *i.e.* the eastern coast of the old world between the latitudes 40° and 62° is in January about 25 degrees Celsius cooler than western Europe; nearly the same difference (28 degrees), as we have obtained by the help of the Thermal Anomalies of table (150) and the charts of Dove.

That Western Europe about 13° *warmer* than the normal temperature, must be ascribed to the effect of the Gulfstream, carrying the heat of the Equator to the N.W., to Western Europe: and that Eastern Asia, on the same latitude, is about 15° *under* the normal temperature, must be attributed to the

effect of the colossal dry continent of Asia, producing in winter through radiation great cold, and sending this cold by W., N.W. and N. winds also to its eastern parts.

The distance between Western Europe and Eastern Asia is about equal to the distance from the equator to the pole, 10,000 kilometres. According to the researches of Dove, supposing, that the temperature varies only with the latitude and not with the longitude, in January the normal mean temperature of the North Pole is—32.°5 and that of the Equator 26.°4. Hence the variation of the temperature, depending only upon the variation of 90 degrees in latitude or 10,000 kilometres of distance, is 58.°9 Celsius; whilst the variation of the temperature, produced by a variation of about 120 degrees in longitude or, in this case of 10,000 Kilometres of distance, is nearly 28°.

Therefore the influence of the longitude on the mean temperature of the air or, in this case, the influence of the contrast between the warm Gulf stream and the cold Eastern part of the colossal dry continent of Asia, or the influence of the distribution of land and water on the mean temperature of January is nearly a half of that of the latitude.

The important part, which the distribution of land and water over the globe plays, not only in regard to the geographical distribution of temperature, but to all other meteorological phenomena, has been observed only lately by meteorologists, and is shown very clearly by means of the excellent charts of Isobaric Lines, and of prevailing winds over the globe, constructed by A. Buchan.

The difference between the mean temperature of January on the same latitude in North China and Japan on the one hand, and in western Europe (Spain, Sicily, Madeira) on the other hand, is on an average, accordingly to (153), A.—E. = —13.°0 Celsius. As Western Europe then, near the latitude 36°, has nearly its normal temperature in January, the greatest part of the difference —13.°0, by which Asia is cooler than Europe, is the effect of the cold, partly produced by the countries themselves under review (North China and Japan), and partly brought about by the continental winds W., N.W. and N. from the interior of Asia.

These continental winds from the cold Inner-Asia make Southern Japan, though surrounded by two warm water currents—Kurosiwo and Tsusima streams—in winter, as cold as Great Britain, which lies about 20° more to the north than Southern Japan [cf. tables (152) and (153). In summer, when these cold continental winds do not blow, Southern Japan,

on account of its low latitude (35°) is about 10° Celsius warmer than Great Britain (latitude 54°). In summer (July) the difference A.—E. for some places is positive, for others negative, because in summer, in Eastern Asia not *only* (as in winter) does the immense dry continent determine the climate, but the ocean also acts an important part, as occurs likewise in Europe.

152

Eastern Europe.	Western Europe.	Latitude. Mean of Eur & Asia.	January. Mean Monthly Temperature. E. Asia. A.	W. Europe. E.	A.—E.	July. Mean Monthly Temperature. E. Asia. A.	W. Europe. E.	A.—E.	Year. Mean Monthly Temperature. E. Asia. A.	W. Europe. E.	A.—E.
Yakutsk,	Hornösand (Scand.)	62°	—40.°8	—8.°7	—32.°1	17.°4	14.°8	+2.°6	—10.°9	2.°4	—13.°3
Okhotsk,	Stockholm	59	—24. 3	—4. 2	—20. 1	13. 1	17. 5	—4. 4	—5. 9	5. 7	—11. 0
Ayan,	Wexiö (Scand.)	57	—20. 9	—2. 7	—18. 2	12. 6	18. 9	—6. 3	—3. 6	6. 9	—10. 5
Nikolajevsk,	Dublin	53	—21. 5	3. 6	—28. 1	16. 2	16. 0	+0. 2	—2. 9	9. 6	—12. 5
Blagoveshchensk,	Plymouth	50	—26. 5	7. 0	—33. 5	22. 1	16. 6	+5. 5	—0. 5	11. 1	—11. 6
Vladivostok,	Toulouse	43	—16. 0	4. 4	—20. 4	18. 7	21. 1	—2. 4	3. 7	12. 9	—9. 2
Newchwang,	Barcelona	41	—12. 0	9. 3	—21. 3	25. 4	26. 0	—0. 6	8. 4	17. 2	—8. 8
Nikolajevsk,	Hamburg	53	—24. 5	—1. 1	—23. 4	16. 2	18. 1	—1. 9	—2. 9	8. 9	—11. 8

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China: Peking,	Lisbon	39°	—4.°6	11.°4	—16.°0	26.°1	22.°3	+3.°8	11.°8	16.°3	—4.°5
China: Chefoo,	Messina	38	—1. 3	12. 4	—13. 7	26. 4	25. 7	+0. 7	13. 4	18. 7	—5. 3
China: Shanghai,	Funchal (Madeira)	32	3. 5	17. 5	—14. 0	28. 1	22. 5	+5. 6	15. 2	19. 8	—4. 6
Japan: Hakodate,	Barcelona	42	—2. 6	9. 3	—11. 9	19. 1	26. 0	—6. 9	8 9	17. 2	—8. 3
Japan: Y'hama,	Gibraltar	36	4. 1	14. 5	—10. 4	23. 3	26. 4	—3. 1	14. 3	19. 6	—5. 3
Japan: Decima,	Funchal (Madeira)	33	5. 6	17. 5	—11. 9	26 2	22. 5	+3. 7	16. 0	19. 8	—3. 8

III.—ATMOSPHERIC PRESSURE.

a. DAILY PERIOD.

The following tables (154)—(155) show the results of observations made on the daily period of the atmospheric pressure.

The heights of the Barometer are given in millimetres (mm.) and corrected to 0° Celsius.

PEKING.

Hourly Range of the Atmospheric Pressure.

Derived from observations made 1841—49 at 5 a.m., 7 a.m., 9 a.m., 11 a.m., 1 p.m., 3 p.m., 5 p.m., 7 p.m., 9 p.m., and 1850—55. Taken from my treatise "On the Climate of Peking."

Millimetres.

154	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
Midnight...	+0.32	+0.45	+0.41	+0.48	+0.38	+0.34
1 ...	+0.29	+0.43	+0.40	+0.42	+0.30	+0.30
2 ...	+0.21	+0.40	+0.36	+0.35	+0.18	+0.22
3 ...	+0.11	+0.36	+0.25	+0.30	+0.13	+0.15
4 ...	+0.07	+0.29	+0.18	+0.34	+0.21	+0.28
5 ...	+0.07	+0.24	+0.26	+0.43	+0.46	+0.52
6 ...	+0.10	+0.30	+0.53	+0.73	+0.81	+0.68
7 ...	+0.36	+0.49	+0.83	+1.04	+1.06	+0.82
8 ...	+0.69	+0.85	+1.10	+1.24	+1.25	+0.94
9 ...	+0.91	+1.01	+1.28	+1.36	+1.28	+0.94
10 ...	+0.97	+0.95	+1.18	+1.22	+1.16	+0.82
11 ...	+0.73	+0.76	+0.86	+0.92	+0.85	+0.66
Noon	+0.11	+0.19	+0.42	+0.42	+0.39	+0.38
1	—0.64	—0.59	—0.37	—0.19	—0.08	—0.11
2	—1.06	—1.18	—0.95	—0.82	—0.56	—0.54
3	—1.13	—1.33	—1.28	—1.24	—1.02	—0.96
4	—1.08	—1.37	—1.52	—1.54	—1.38	—1.22
5	—0.88	—1.26	—1.53	—1.71	—1.52	—1.40
6	—0.62	—0.98	—1.31	—1.60	—1.48	—1.36
7	—0.36	—0.54	—0.87	—1.20	—1.27	—1.03
8	—0.09	—0.22	—0.44	—0.74	—0.78	—0.57
9	+0.19	+0.04	—0.12	—0.33	—0.35	—0.17
10	+0.32	+0.25	+0.11	—0.02	—0.08	+0.05
11	+0.32	+0.37	+0.25	+0.23	+0.13	+0.18

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	mm.	mm.	mm.	mm.	mm.	mm.
Midnight...	+0.18	+0.18	+0.11	+0.13	+0.29	+0.37
1 ...	+0.12	+0.10	+0.07	+0.13	+0.24	+0.36
2 ...	0.00	+0.01	—0.01	+0.08	+0.18	+0.30
3 ...	—0.08	0.00	—0.05	—0.01	+0.08	+0.24
4 ...	—0.02	+0.03	0.00	—0.01	+0.01	+0.12
5 ...	+0.13	+0.13	+0.21	+0.17	+0.02	+0.02
6 ...	+0.31	+0.29	+0.43	+0.43	+0.14	+0.03

PEKING.—*Continued.*

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	mm.	mm.	mm.	mm.	mm.	mm.
7 ...	+0.49	+0.46	+0.61	+0.73	+0.44	+0.21
8 ...	+0.63	+0.61	+0.81	+1.04	+0.72	+0.54
9 ...	+0.73	+0.72	+0.96	+1.21	+0.92	+0.85
10 ...	+0.67	+0.69	+0.97	+1.11	+0.93	+0.91
11 ...	+0.51	+0.55	+0.68	+0.87	+0.64	+0.61
Noon	+0.30	+0.34	+0.29	+0.38	+0.10	+0.03
1	+0.04	—0.04	—0.13	—0.29	—0.52	—0.66
2	—0.28	—0.36	—0.50	—0.71	—0.87	—0.98
3	—0.53	—0.64	—0.89	—0.97	—1.01	—1.14
4	—0.71	—0.84	—1.04	—1.09	—1.03	—1.01
5	—0.82	—0.93	—1.07	—1.16	—0.91	—0.80
6	—0.82	—0.88	—0.98	—1.01	—0.64	—0.54
7	—0.70	—0.58	—0.59	—0.69	—0.34	—0.25
8	—0.43	—0.26	—0.27	—0.41	—0.05	+0.02
9	—0.07	+0.01	—0.01	—0.12	+0.15	+0.23
10	+0.13	+0.17	+0.16	+0.08	+0.28	+0.33
11	+0.20	+0.28	+0.25	+0.21	+0.37	+0.39

SHANGHAI.

HOURLY RANGE OF THE ATMOSPHERIC PRESSURE.

Derived from observations, made during about two years, 1873 and 1875-76.

155	Winter.	Spring.	Summer.	Autumn.
	mm.	mm.	mm.	mm.
Midnight	+0.21	+0.19	+0.03	+0.14
1	+0.13	+0.06	—0.12	+0.02
2	0.00	—0.15	—0.25	—0.13
3	—0.13	—0.30	—0.36	—0.30
4	—0.22	—0.33	—0.40	—0.35
5	—0.18	—0.26	—0.25	—0.21
6	—0.02	+0.03	0.00	+0.04
7	+0.24	+0.38	+0.28	+0.35
8	+0.55	+0.60	+0.45	+0.58
9	+0.81	+0.80	+0.56	+0.77
10	+0.91	+0.86	+0.58	+0.81
11	+0.63	+0.69	+0.50	+0.55
Noon	—0.02	+0.33	+0.26	+0.10
1	—0.57	—0.13	—0.03	—0.44
2	—0.85	—0.52	—0.18	—0.71
3	—0.88	—0.77	—0.50	—0.78
4	—0.79	—0.90	—0.62	—0.73

SHANGHAI.—*Continued*

	Winter.	Spring.	Summer.	Autumn.
	mm.	mm.	mm.	mm.
5	—0.58	—0.86	—0.60	—0.59
6	—0.31	—0.70	—0.46	—0.36
7	—0.02	—0.35	—0.23	—0.08
8	+0.15	+0.04	+0.08	+0.14
9	+0.28	+0.30	+0.37	+0.31
10	+0.38	+0.47	+0.51	+0.40
11	+0.34	+0.50	+0.47	+0.40

DECIMA.

Hourly Range of the Atmospheric Pressure.

Derived from observations made during 10 years 1845—1855 at 6 a.m., 9 a.m., 3½ p.m., 10 p.m., and Hourly One Day every Month. See Meteorologische Waarnemingen in Nederland Zijne Bezittingen, 1856.

156	Winter.	Spring.	S'mer.	A'tumn.	Year.
	mm.	mm.	mm.	mm.	mm.
Midnight	+0. 22	+0. 32	+0. 26	+0. 29	+0. 27
1	+0. 14	+0. 35	+0. 28	+0. 11	+0. 22
2	+0. 12	+0. 46	+0. 21	+0. 06	+5. 21
3	+0. 13	+0. 49	+0. 15	+0. 08	+0. 21
4	+0. 07	+0. 54	+0. 07	+0. 09	+0. 19
5	+0. 13	+0. 53	+0. 04	—0. 02	+0. 17
6	+0. 11	+0. 56	+0. 07	+0. 06	+0. 20
7	+0. 12	+0. 30	+0. 05	+0. 22	+0. 17
8	+0. 29	+0. 20	+0. 09	+0. 52	+0. 27
9	+0. 39	+0. 29	+0. 12	+0. 33	+0. 28
10	+0. 38	—0. 06	+0. 16	+0. 57	+0. 26
11	+0. 33	—0. 26	+0. 29	+0. 42	+0. 20
Noon..............	+0. 20	—0. 37	+0. 24	+0. 27	+0. 08
1	0. 00	—0. 44	+0. 16	—0. 03	—0. 08
2	—0. 28	—0. 71	—0. 12	—0. 51	—0. 40
3	—0. 45	—0. 44	—0. 31	—0. 59	—0. 43
4	—0. 40	—0. 33	—0. 40	—0. 59	—0. 43
5	—0. 57	—0. 51	—0. 54	—0. 56	—0. 55
6	—0. 51	—0. 43	—0. 48	—0. 62	—0. 51
7	—0. 40	—0. 32	—0. 39	—0. 37	—0. 37
8	—0. 12	—0. 28	—0. 13	—0. 21	—0. 19
9	—0. 05	—0. 06	—0. 11	+0. 05	—0. 05
10	+0. 02	—0. 01	+0. 07	+0. 22	+0. 07
11	+0. 17	+0. 11	+0. 14	+0. 17	+0. 14

SI-WAN-TZE.

2 Years, September, 1873—September, 1875.

157 MONTHLY MEANS.

	7 a.m.	1 p.m.	8 p.m.	Mean.
	mm.	mm.	mm.	mm.
January	663. 1	662. 7	662. 5	662. 8
February	661. 9	661. 3	662. 2	661. 8
March	660. 6	660. 5	660. 4	660. 5
April	658. 6	658. 2	658. 0	658. 3
May	657. 4	657. 0	656. 9	657. 1
June	656. 3	656. 0	655. 9	656. 1
July	655. 8	655. 2	665. 2	655. 4
August	658. 3	657. 9	658. 1	658. 1
September	661. 4	660. 9	660. 8	661. 0
October	664. 0	663. 1	662. 9	663. 3
November	662. 9	662. 6	662. 7	662. 7
December	662. 2	661. 6	662. 4	662. 1
Mean	660. 2	659. 7	659. 8	659. 9

NEW-CHWANG.

1 Year, 1872.

MONTHLY MEANS.

158	4 a.m.	9 a.m.	Noon.	3 p.m.	8 p.m.	Mean.
	mm.	mm.	mm.	mm.	mm.	mm.
January	771. 8	771. 8	771. 2	771. 0	771. 4	771. 4
February	771. 7	771. 7	771. 1	770. 9	771. 2	771. 3
March	763. 5	763. 3	763. 1	762. 4	762. 6	763. 0
April	760. 1	760. 7	760. 3	759. 8	760. 1	760. 2
May	755. 3	755. 8	755. 3	754. 7	755. 4	755. 3
June	755. 1	755. 3	755. 1	754. 7	755. 1	755. 1
July	749. 4	749. 3	749. 1	748. 9	749. 4	742. 2
August	750. 5	750. 6	750. 3	749. 5	750. 7	750. 3
September	758. 8	758. 6	758. 6	758. 2	759. 0	758. 7
October	763. 0	763. 1	762. 8	762. 2	762. 5	762. 7
November	765. 0	765. 4	765. 6	764. 9	764. 8	765. 1
December	764. 3	764. 6	764. 6	764. 0	764. 6	764. 4
Mean	760. 7	760. 9	760. 6	760. 1	760. 6	760. 6

TAKU.

Monthly Means.

159

1873	7 a.m.	1 p.m.	9 p.m.	Mean.
	mm.	mm.	mm.	mm.
January	773. 0	771. 6	772. 5	772. 4
February	769. 1	768. 1	768. 0	768. 4
March	766. 8	766. 5	766. 3	766. 5
April	759. 4	759. 4	750. 4	759. 4
May	757. 2	756. 2	756. 2	756. 5
June	755. 5	754. 9	754. 7	755. 0
July	752. 3	752. 3	762. 6	752. 4
August	755. 2	755. 1	755. 2	755. 2
September	760. 7	760. 4	760. 4	760. 5
October	764. 8	764. 5	764. 5	764. 6
November	766. 8	767. 1	767. 9	767. 3
December	770. 4	769. 9	770. 1	770. 1

1874	7 a.m.	1 p.m.	9 p.m.	Mean.
	mm.	mm.	mm.	mm.
January	772. 6	771. 9	772. 6	772. 4
February	769. 9	769. 9	770. 1	770. 0
March	768. 6	768. 1	767. 6	768. 1
April	761. 2	759. 9	759. 9	760. 3
May	755. 7	754. 7	755. 2	755. 2
June	754. 1	753. 1	753. 3	753. 5
July	753. 1	753. 3	753. 1	753. 2
August	754. 4	753. 6	753. 6	753. 9
September	761. 4	760. 7	760. 7	760. 9
October	768. 0	767. 4	767. 6	767. 7
November	770. 4	768. 9	769. 9	769. 7
December	769. 9	769. 6	769. 9	769. 8

1875	7 a.m.	1 p.m.	9 p.m.	Mean.
	mm.	mm.	mm.	mm.
January	761. 4	770. 6	770. 9	771. 0
February	769. 9	769. 6	769. 9	769. 8
March	764. 5	764. 3	764. 5	764. 4
April	760. 9	759. 9	760. 7	760. 5
May	758. 4	757. 9	757. 7	758. 0
June	754. 1	753. 1	753. 3	753. 5
July	751. 8	751. 6	751. 3	751. 6
August	756. 7	756. 2	756. 2	766. 4
September	760. 7	760. 4	760. 4	760. 5
October	766. 3	765. 8	765. 5	765. 9
November	769. 6	768. 9	768. 9	769. 1
December	771. 9	771. 1	771. 9	771. 6

MEANS OF THE THREE YEARS 1873—75:

160	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
7 a.m.,...	772. 3	769. 6	766. 6	760. 5	757. 1	754. 6
1 p.m.,...	771. 4	769. 2	766. 3	759. 7	756. 3	753. 7
9 p.m.,...	772. 0	769. 3	766. 1	760. 0	756. 4	753. 8
Mean ...	771. 9	769. 4	766. 3	760. 1	756. 6	754. 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Mean.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
7 a.m.,...	752. 4	755. 4	760. 9	766. 4	768. 9	770. 7	762. 9
1 p.m.,...	752. 4	755. 0	760. 5	765. 9	768. 3	770. 2	762. 4
9 p.m.,...	752. 3	755. 0	760. 5	765. 9	768. 9	770. 6	762. 6
Mean ...	752. 4	755. 1	760. 6	766. 1	768. 7	770. 5	762. 6

OSAKA.

1 Year, 1870.

MONTHLY MEANS.

161	8 a.m.	Noon.	10 p.m.
	mm.	mm.	mm.
Winter	764.4	763.2	763.9
Spring	761.3	760.5	761.3
Summer	756.8	756.5	757.2
Autumn	763.0	762.0	762.4
Mean	761.4	760.6	761.2

YOKOHAMA.

1 Year, 1870.

MONTHLY MEANS.

162	7 a.m.	2 p.m.	9 p.m.
	mm.	mm.	mm.
January	762.1	759.6	760.9
February	763.3	761.6	761.9
March	761.8	760.2	761.4
April	761.9	760.5	761.3
May	761.7	759.5	760.1
June	758.0	757.1	757.6
July	756.7	755.9	756.7
August	756.3	755.4	756.2
September	759.4	758.4	759.3
October	762.0	760.5	761.9
November	765.9	764.9	765.7
December	760.1	759.2	760.0
Mean	760.8	759.4	760.2

KELUNG.

$1\frac{1}{12}$ Years, September 1873—August 1875.

163 MONTHLY MEANS.

	7 a.m.	1 p.m.	9 p.m.
	mm.	mm.	mm.
January	766.5	765.7	766.6
February	765.0	764.6	765.1
March	763.0	762.5	763.0
April	761.2	760.7	761.0
May	756.8	756.2	756.6
June	754.6	754.0	754.4
July	751.8	751.0	751.7
August	752.6	751.8	752.6
September	752.4	752.0	752.7
October	759.0	758.4	759.5
November	764.1	763.2	764.1
December	764.3	763.5	764.3
Mean	759.3	758.5	759.3

According to this, the height of the Barometer reaches in Eastern Asia, as is usually observed in other countries, every day two maxima and two minima; one principal maximum in the morning between 9 and 10 o'clock, one principal minimum in the afternoon between 4 and 5 o'clock, one secondary maximum at midnight, and one secondary minimum in the morning between 3 and 5 o'clock.

Unfortunately, we know exactly these times only for three places, Peking, Shanghai and Decima, hourly observations not having been made at our other forty stations in Eastern Asia.

TIMES OF THE DAILY MINIMA OF THE ATMOSPHERIC PRESSURE.

ABSOLUTE MINIMUM—AFTERNOON.

164	Jan.	Feb.	Mar.	Apr.	May.	June.
	h.	h.	h.	h.	h.	h.
Peking	3.0	3.8	4.5	5.0	5.1	5.1
Shanghai	2.8	...	...	4.3	...	...
Decima	5.3	...	...	5.3	...	...
	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h.	h.	h.	h.	h.	h.
Peking	5.5	5.1	5.0	5.0	3.8	3.0
Shanghai	4.4	...	...	3.2	...	...
Decima	5.3	...	...	5.0	...	...

Secondary Minimum—Forenoon.

165	Jan.	Feb.	Mar.	Apr.	May.	June.
	h.	h.	h.	h.	h.	h.
Peking	4.4	5.0	4.0	3.0	3.0	3.0
Shanghai	4.3	...	...	3.7	...	...
Decima	4.0	...	...	...	...	...

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h.	h.	h.	h.	h.	h.
Peking	3.0	3.0	3.0	3.5	4.4	5.4
Shanghai	3.7	...	...	3.7	...	...
Decima	5.0	...	...	5.0	...	...

TIMES OF THE DAILY MAXIMA OF THE ATMOSPHERIC PRESSURE.

Absolute Maximum—Forenoon.

166	Jan.	Feb.	Mar.	Apr.	May.	June.
	h.	h.	h.	h.	h.	h.
Peking	10.0	·9.2	9.1	9.0	8.9	8.5
Shanghai	9.7	...	...	9.7	...	...
Decima	9.7	...	...	5.0	...	...

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h.	h.	h.	h.	h.	h.
Peking	9.1	9.2	9.6	9.2	9.5	9.7
Shanghai	9.7	...	...	9.7	...	...
Decima	11.3	...	...	10.3	...	...

Secondary Maximum—Near Midnight.

167	Jan.	Feb.	Mar.	Apr.	May.	June.
	h.	h.	h.	h.	h.	h.
Peking	10.5 p.	0.5 a.	0.5 a.	0.1 a.	0.1 a.	0.1 a.
Shanghai	10.5 p.	...	...	10.7 p.	...	...
Decima	11.9 p.	...	...	...	...	...

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
	h.	h.	h.	h.	h.	h.
Peking	11.5 p.	11.5 p.	11.0 p.	11.7 p.	11.3 p.	11.7 p.
Shanghai	10.5 p.	...	...	10.3 p.	...	...
Decima	0.7 a.	...	...	11.7 p.	...	...

MEAN DAILY AMPLITUDE OF THE ATMOSPHERIC PRESSURE;

MAXIMUM 9 A.M.—MINIMUM 4 P.M.—TABLE (168).

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years ob'vd.	
	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.		
Newchwang..	0.8	0.8	0.9	0.9	1.1	0.6	0.4	1.1	0.7	0.9	0.5	0.6	0.8	1	Table (158).
Peking......	2.1	2.4	2.8	3.1	2.8	2.3	1.6	1.7	2.0	2.4	2.0	2.1	2.3	15	Table (154).
Chefoo......	0.7	..	..	..	..	..	1.5	1.0	0.7	0.5	0.7	0.5	..	$\frac{7}{12}$	10 a.m—4 p.m., 1871—72.
Shanghai ..	1.8	..	..	1.8	..	..	1.2	..	..	1.6	..	..	1.6	2	Table (155).
Fu-cheu-foo..	..	..	..	2.2	1.3	1.8	1.6	2.2	2.4	2.8	2.0	2.7	..	$\frac{9}{12}$	9 a.m.—3 p.m.
Decima	1.0	..	..	1.1	..	..	0.8	..	..	1.2	..	..	1.0	10	Table (156).
Victoria	2 5	2.4	2.4	2.1	1.8	1.4	1.3	1.6	1.9	2.2	2.2	2.3	2.0	6	9½ a.m.—3¾ p.m. Z. d. Oest. G. f. Meteorol. T. [VIII, p. 78.
Victoria Peak	1.5	1.8	1.0	1.0	0.8	0.8	0.6	0.5	0,8	1.0	1.0	1.0	1.0	$2\frac{1}{3}$	9 a.m.—3 p.m. " " " [VIII, p. 219.

MAXIMUM 11 P.M.—MINIMUM 4 A.M.—TABLE (169).

	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	
	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	Mm.	
Peking......	0.3	0.2	0.2	0 2	0.2	0.2	0.3	0.3	0.3	0.2	0.4	0.4	0.27	Tab'e (154.)
Shanghai ..	0 6	..	..	0.8	..	..	0.9	..	..	0.7	..	..	..	" (155.)
Decima	0.2	..	..	0.0	..	..	0.2	..	..	0.3	..	..	..	" (156.)

As the amount of the mean daily amplitude of atmospheric pressure mainly depends upon the amount of the mean daily amplitude of temperature and of pressure of aqueous vapour, and upon the modus of co-operation of the daily periods of temperature and pressure of a vapour, the mean daily principal amplitude, (168), in China is considerable, especially at Peking; where, notwithstanding Peking is located under latitude 40°, it is very little less than the amplitude at the equator, which is on an annual average equal to about 2.6 millimetres.

The Amoor-Territory (Nirchinsk, Nikolajevsk), and probably also Japan have much smaller daily amplitudes of barometric height, as also Western Siberia and Europe, where they scarcely

reach 1mm.; and in many places, as for example at St. Petersburg, nearly approach zero.

On the annual period of the daily principal amplitude of the atmospheric pressure (168), I cannot say much. Only for Peking and Victoria is this period exactly determined. The records at these two places prove, that the amount of the mean daily amplitude of the atmospheric pressure is comparable with the mean daily amplitude of the temperature of the air [cf. the above tables (22) and (23)], depending upon the height of the sun above the horizon (the season) and the moisture.

ABSOLUTE MAXIMA AND MINIMA OF THE ATMOSPHERIC PRESSURE.

If more than one year has been observed, the *mean* of the absolute Maxima and Minima of the single years is inserted in the following tables (170)—(192), similarly to what has been done above, in constructing the tables (33)—(61).

	NIKOLAJEVSK. 1 year ; 1872.			NERCHINSK. 3 years ; 1872-74.		
170	Max.	Min.	Diff.	171 Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	761.7	744.9	16.8	722.0	699.7	22.3
February	763.9	749.8	14.1	718.2	695.6	22.6
March	761.9	749.3	12.6	719.4	622.0	27.4
April	764.1	750.7	13.4	715.7	685.5	30.2
May	761.7	748.7	13.0	709.6	691.3	18.3
June	761.0	748.7	12.3	707.1	694.0	13.1
July	757.6	742.9	14.7	707.2	690.0	17.2
August	756.9	747.9	9.0	708.2	690.4	17.8
September ...	761.4	741.8	19.6	715.7	696.9	18.8
October	760.6	742.9	17.7	717.2	694.3	22.9
November......	761.6	744.8	16.8	714.8	694.5	20.3
December	762.8	741.2	21.6	719.8	693.9	25.9
Year	764.1	741.2	22.9	724.3	685.3	39.0

	VLADIVOSTOK. $1\frac{1}{2}$ year ; 1873.			SI-WAN-TSE. 2 years ; Sept. 1873—August 1875.		
172	Max.	Min.	Diff.	173 Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	......	......	......	671.5	657.0	14.5
February	769.2	745.9	23.3	672.2	655.5	16.7
March	767.9	741.8	26.1	672.3	650.6	21.7

	VLADIVOSTOK—*Continued.*			SI-WAN-TSE—*Con.*		
	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
April	765.0	742.9	22.1	664.1	648.4	15.7
May	757.9	747.7	10.2	662.6	650.3	12.3
June	759.3	744.9	14.4	661.0	651.6	9.4
July	762.8	746.2	16.6	661.5	650.2	11.3
August	759.8	744.4	15.4	665.4	653.2	12.2
September ...	763.4	744.1	19.3	666.4	657.2	9.2
October.........	766.1	746.5	19.6	674.0	653.7	18.3
November......	765.5	750.1	15.4	671.5	656.2	15.3
December......	777.9	767.9	30.0	677.0	652.2	24.8
Year	......	......	......	680.0	647.7	32.3

	KALGAN. $\frac{7}{12}$ year; 1871-72.			NEWCHWANG. 2 years; 1862 and 1872.		
174	Max.	Min.	Diff.	175 Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	702.6	686.1	16.5	779.3	763.5	15.8
February	700.6	692.4	8.2	780.3	762.3	18.0
March	......	......	......	773.8	752.2	21.6
April............	......	......	......	768.8	751.6	17.2
May	......	......	..... .	763.3	747.3	16.0
June	......	......	......	761.5	748.7	12.8
July	......	......	......	756.4	742.0	14.4
August	689.4	679.2	10.2	757.6	743.0	14.6
September ...	695.0	684.8	10.2	764.5	752.9	11.6
October.........	698.9	687.5	11.4	770.7	754.7	16.0
November ...	700.1	685.6	14.5	773.7	756.5	17.2
December......	705.6	688.7	16.9	774.5	754.3	20.2
Year	......	......	......	779.3	742.0	37.3

PEKING.

33 years; 1841—1874.

176	Max.	Min.	Diff.
	mm.	mm.	mm.
January	776.8	758.5	18.3
February	776.2	754.8	21.4
March	772.7	750.1	22.6
April..................................	768.4	746.7	21.7

PEKING—*Continued.*

	Max.	Min.	Diff.
	mm.	mm.	mm.
May	763.9	744.7	19.2
June	757.5	743.5	14.0
July	755.1	742.8	12.3
August	758.6	745.2	13.4
September	765.2	750.3	14.9
October	771.3	753.7	17.6
November	775.2	756.1	19.1
December	776.8	755.8	21.0
Year	779.0	741.9	37.1

TIENTSIN. — TAKU.

	TIENTSIN. 1 year; 1872.			TAKU. 3 years; 1873-75.		
177 / 178	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	780.9	761.1	19.8	778.3	763.6	14.7
February	779.1	765.6	13.5	777.5	757.8	19.7
March	777.2	753.4	23.8	777.7	755.4	22.3
April	772.7	753.8	18.9	769.2	748.5	20.7
May	764.9	752.0	12.9	766.7	748.7	18.0
June	762.2	752.3	9.9	758.3	748.8	9.5
July	756.4	746.6	9.8	757.5	747.1	10.4
August	759.4	749.8	9.6	761.6	750.1	11.5
September	763.7	755.3	8.4	767.9	752.7	15.2
October	771.3	760.5	10.8	773.6	755.5	18.1
November	772.9	762.1	10.8	778.0	759.6	18.4
December	775.4	759.1	16.3	782.2	759.4	22.8
Year	780.9	746.6	34.3	782.2	747.1	35.1

CHEFOO. — SHANGHAI.

	CHEFOO. $\frac{7}{12}$ year; 1871-72.			SHANGHAI. $1\frac{1}{2}$ year; 1875-76		
179 / 180	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	778.2	761.2	17.0	779.5	765.1	14.4
February	......	......	.....	772.9	760.5	12.4
March	......	......	......	......	......	......
April	......	......	......	770.2	753.3	16.9
May	......	......	......	767.4	751.7	15.7

	CHEFOO—*Continued.*			SHANGHAI—*Con.*		
	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
June	......	......	......	759.4	749.3	10.1
July	761.2	749.8	11.4	757.2	747.3	9.9
August	764.0	753.6	10.4	759.8	742.3	17.5
September ...	771.4	758.7	12.7	764.4	752.1	12.3
October.........	771.9	763.0	8.9	769.0	759.5	9.5
November......	777.7	763.8	13.9	773.5	758.1	15.4
December......	777.7	767.9	9.8	778.5	762.6	15.9
Year	......	......	......	779.5	742.3	37.2

	VICTORIA. 6 years.			DUI. 1 year; 1874.			
181	Max.	Min.	Diff.	182	Max.	Min.	Diff.
	mm.	mm.	mm.		mm.	mm.	mm.
January	772.9	759.5	13.4		769.1	750.8	18.3
February	773.3	758.6	14.1		768.8	750.1	18.7
March	771.4	758.2	13.2		767.5	750.1	17.4
April	766.2	755.7	10.5		762.5	748.3	14.2
May	763.1	754.0	9.1		761.5	743.5	18.0
June	760.2	751.0	9.2		753.6	740.9	12.7
July	759.0	748.9	10.1		753.6	743.0	10.6
August	759.6	749.1	10.5		754.1	746.0	8.1
September ...	762.4	749.7	12.7		757.2	744.5	12.7
October.........	766.9	755.2	11.7		764.8	743.5	21.3
November......	769.5	759.7	9.8		763.3	744.0	19.3
December	771.9	761.0	10.9		769.3	749.1	20.2
Year	774.6	746.7	27.9		769.3	740.9	28.4

	YEDO. 2 years; Oct. 1872—Sept. 1874.			YOKOHAMA. 1 year; 1865.			
183	Max.	Min.	Diff.	184	Max.	Min.	Diff.
	mm.	mm.	mm.		mm.	mm.	mm.
January	773.1	748.2	24.9		769.7	746.0	23.7
February	772.5	753.7	18.8		771.6	744.2	27.4
March	776.0	750.3	25.7		773.0	750.9	22.1
April............	769.6	747.9	21.7		769.6	744.5	25.1
May	768.8	748.8	20.0		770.4	746.1	24.3
June............	766.9	750.5	16.4		765.1	750.7	14.4
July	763.8	747.9	15.9		761.6	744.2	17.4

	YEDO—*Continued.*			YOKOHAMA—*Con.*		
	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
August	765.0	749.0	16.0	761.7	744.2	17.5
September ...	767.9	730.0	37.9	769.0	753.6	15.4
October.........	771.2	750.5	20.7	768.5	753.1	15.4
November ...	776.1	749.1	27.0	773.7	747.3	16.4
December......	774.0	750.3	23.7	778.4	752.4	26.0
Year	776.3	730.0	46.3	778.4	744.2	34.2

	DECIMA. 3 years.				KELUNG. 2 years; Sept. 1873—Aug. 1875.		
185	Max.	Min.	Diff.	186	Max.	Min.	Diff.
	mm.	mm.	mm.		mm.	mm.	mm.
January	773.1	755.6	17.5		772.6	759.9	12.7
February	771.8	755.9	15.9		771.8	758.7	12.4
March	771.8	755.9	15.9		768.6	757.3	11.3
April............	768.4	753.2	15.2		766.2	754.0	12.2
May	764.7	751.8	12.9		763.5	749.6	13.9
June............	762.4	750.3	12.1		758.2	750.2	8.0
July	761.6	749.9	11.7		755.8	743.1	12.7
August	761.3	749.2	12.1		756.9	744.7	12.2
September ...	763.6	752.0	11.6		757.0	742.6	14.4
October	770.6	757.9	12.7		766.1	751.6	14.5
November ...	770.8	759.0	11.8		768.3	758.5	9.8
December......	771.3	759.5	11.8		770.1	757.5	12.6
Year	774.4	747.6	26.8		772.6	740.3	32.3

	MANILA.				ST. PETERSBURG. 3 years; 1872—1874.		
187	Max.	Min.	Diff.	188	Max.	Min.	Diff.
			mm.		mm.	mm.	mm.
January	......	......	7.2		774.9	734.7	40.2
February	......	......	7.5		786.0	738.2	47.8
March	......	......	6.7		778.8	738.4	40.4
April............	......	......	6.2		772.8	738.7	34.1
May	......	......	7.1		767.2	743.8	23.4
June............	......	......	5.8		768.7	745.4	23.3
July	......	......	7.0		766.5	750.4	16.1
August.........	......	......	9.7		765.8	744.0	21.8
September ...	......	......	9.0		767.7	740.8	26.9
October	......	......	8.1		769.6	740.5	29.2

	MANILA—*Continued.*			ST. PETERSBURG—*Con.*		
	Max.	Min.	Diff.	Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
November ...	......	......	4.5	774.5	735.4	39.1
December......	......	......	6.8	773.3	731.6	41.7
Year...........	......	......	15.5	786.3	724.9	61.4

	WARSAW. 3 years; 1872—1874.			ODESSA. 3 years; 1872—1844.		
189	Max.	Min.	Diff.	190 Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	763.3	731.2	32.1	770.0	741.4	28.6
February	764.5	736.2	28.3	772.3	742.9	29.4
March	767.0	734.2	32.8	775.5	746.8	28.7
April...........	758.4	736.0	22.4	765.1	745.4	19.7
May	755.1	735.9	19.2	762.9	745.8	17.1
June...........	756.0	741.0	15.0	761.2	747.0	14.2
July	756.6	742.4	14.2	760.5	747.8	12.7
August.........	758.5	740.7	17.8	761.9	748.2	13.7
September ...	759.1	739.6	19.5	764.4	749.2	15.2
October	761.5	740.3	21.2	769.4	750.4	19.0
November ...	761.3	730.8	30.5	768.3	743.4	24.9
December......	763.0	729.4	33.6	771.5	743.0	28.5
Year...........	768.7	728.4	40.3	776.7	737.8	38.9

	JEKATERINBURG. 3 years; 1872—1874.			BARNAUL. 3 years; 1872—1874.		
191	Max.	Min.	Diff.	192 Max.	Min.	Diff.
	mm.	mm.	mm.	mm.	mm.	mm.
January	754.0	725.6	28.4	773.5	743.6	29.9
February	752.6	715.1	37.5	769.0	741.1	27.9
March	750.8	716.9	33.9	768.8	736.0	32.8
April...........	746.6	721.3	25.3	764.5	735.3	24.3
May	747.4	722.5	24.9	757.8	733.5	24.3
June...........	744.1	717.9	26.2	752.7	731.3	21.4
July	738.5	717.5	21.0	747.3	730.1	17.2
August.........	743.6	721.1	22.5	751.2	734.9	16.3
September ...	745.5	714.8	30.7	758.3	737.2	21.1
October.........	752.0	719.4	32.6	767.0	733.3	33.7
November ...	752.6	717.7	34.9	771.4	739.4	32.0
December......	748.2	717.8	30.4	767.6	736.9	30.7
Year...........	757.1	707.8	49.3	777.2	729.9	47.3

DIFFERENCES OF THE ARSOLUTE MAXIMA AND MINIMA OF THE ATMOSPHERIC PRESSURE.

Continent of Eastern Asia.—Table (193.)

	Jan.	Feb.	Mar.	Apr.	May.	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years obv'd.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.		
Nikolajevsk	16.8	14.1	12.6	13.1	13.0	12.3	14.7	9.0	19.6	17.7	16.8	21.6	22.9	1	Table (170.)
Nerchinsk	22.3	22.4	27.4	30.2	18.3	13.1	17.2	17.8	18.8	22.9	20.3	25.9	29.9	3	" (171.)
Vladivostok	......	23.3	26.1	22.1	10.2	14.4	16.6	15.4	19.3	19.6	15.4	30.0	......	11/12	" (172.)
Si-wan-tse	14.5	16.7	21.7	15.7	12.3	9.4	11.3	12.2	9.2	18.3	15.3	24.8	32.3	2	" (173.)
Kalgan	16.5	8.2	......	......	......	......	......	10.2	10.2	11.1	14.5	16.9	......	7/12	" (174.)
Newchwang	15.8	18.0	21.6	17.2	16.0	12.8	14.4	14.6	11.6	16.0	17.2	20.2	37.3	2	" (175.)
Peking	18.3	21.4	22.6	21.7	19.2	14.0	12.3	13.4	14.9	17.6	19.1	21.0	37.1	23	" (176.)
Tientsin	19.8	13.5	23.8	18.9	13.9	9.9	9.8	9.6	7.4	10.8	10.8	16.3	34.3	1	" (177.)
Taku	14.7	19.7	22.3	20.7	18.0	9.5	10.4	11.5	15.2	18.1	18.4	22.8	35.1	3	" (178.)
Chefoo	17.0	......	......	......	......	......	11.4	10.4	12.7	8.9	13.6	9.8	......	7/12	" (179.)
Shanghai	14.4	12.4	......	16.9	15.7	10.1	9.9	17.5	12.3	9.5	15.4	15.9	37.2	11/12	" (180.)

Islands of Eastern Asia.—Table (194.)

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec	Year.	No. of years obv'd.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.		
Dui	18.3	18.7	17.4	14.2	18.0	12.7	10.6	8.1	12.7	21.3	19.3	20.2	28.4	1	Table (182.)
Yedo	24.9	18.8	25.7	21.7	20.0	16.4	15.9	16.0	37.9	20.7	27.0	23.7	46.3	2	" (183.)
Yokohama	23.7	27.4	22.1	25.1	24.3	14.4	17.4	17.5	15.4	15.4	16.4	26.0	34.2	1	" (184.)
Decima	17.5	15.9	15.9	15.2	12.9	12.1	11.7	12.1	11.6	12.7	11.8	11.8	26.8	3	" (185.)
Kelung	12.7	12.4	11.3	12.2	13.9	8.0	12.7	12.2	14.4	14.5	9.8	12.6	32.3	2	" (186.)
Victoria	13.4	14.7	13.2	10.5	9.1	9.2	10.1	10.5	12.7	11.7	9.8	10.9	27.9	6	" (181.)
Manila	7.2	7.5	6.7	6.2	7.1	5.8	7.0	9.7	9.0	8.1	4.5	6.8	15.5	...	" (187.)

TABLE (195).

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years obv'd.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.		
Barnaul	29.9	27.9	32.8	29.2	24.3	21.4	17.2	16.3	21.1	33.7	32.0	30.7	47.3	3	Table (192.)
Jekaterinburg	28.4	37.5	33.9	25.3	24.9	26.2	21.0	22.5	30.7	32.6	34.9	30.4	49.3	3	" (191.)
St. Petersburg	40.2	47.8	40.4	34.1	23.4	23.3	16.1	21.8	26.9	29.2	39.1	41.7	61.4	3	" (188.)
Stockholm	37.2	38.4	29.6	25.5	26.0	23.9	19.6	23.9	29.6	32.0	35.9	38.4	......	10	Kämtz.
Warsaw	32.1	28.3	32.8	22.4	19.2	15.0	14.2	17.8	19.5	21.2	30.5	33.6	40.3	3	" (189.)
Odessa	28.6	29.4	28.7	19.7	17.1	14.2	12.7	13.7	15.2	19.0	24.9	28.5	38.9	3	" (190.)
Hamburg	32.5	30.9	33.1	21.1	21.7	19.4	15.8	16.5	21.7	26.6	29.1	32.7	......	18	Kämtz.
Paris	29.8	29.3	27.1	25.9	20.3	18.5	15.3	17.6	21.9	18.0	27.5	32.0	......	42	"
Funchal	14.7	13.3	11.7	12.2	9.7	8.1	5.4	5.2	7.2	10.6	12.6	14.0	......	8	"
Havannah	11.3	9.0	7.2	5.4	3.1	4.3	3.6	3.6	6.3	8.4	5.9	8.6	......	3	"

For all places within the tables (193), (194) and (195), showing the irregular absolute fluctuations of barometer within each month and year, the oscillations mark a sharply defined minimum in summer and a maximum in the cold season, generally in spring.

In many places, a second maximum in autumn and a second minimum in winter do not occur: at others they are not distinctly expressed.

The monthly range of the values, contained in the tables (193)-(195) is, as is not difficult to comprehend, similar to the monthly range of the absolute oscillation of the temperature [tables (62) and (63)], the atmospheric pressure being in a close connection with the temperature of the air.

The barometer, in the northern hemisphere, is least fluctuating during the summer; and during the cool months of the year most fluctuating.

The variation of the monthly barometric non-periodic oscillation from spring to summer is in Northern China, Japan and the Amoor-Territory about 10 millimetres: in Southern China and Formosa about 5 millimetres, therefore much smaller than at places in table (195), situated to the west of Eastern Asia.

On the Eastern Asiatic continent the monthly irregular barometric oscillation—table (193)

varies between 8 and 30 millimetres; therefore the mean value will be nearly 19 millimetres; it decreases generally from N. to S.

On the East Asiatic islands—table (194)—it ranges between 4 and 27 mm. (excepting the extraordinarily great value 37.9 mm. at Yedo, produced by a typhoon in the neighbouring ocean); therefore the mean is about 15mm., a little less than the mean of the continent—19mm.

The annual barometric irregular, non-periodic, fluctuation is likewise on the continent of Eastern Asia little greater than on the islands.

The absolute values of the monthly irregular fluctuation in places lying West of Eastern Asia, according to tables (195), (194) and (193), [excepting only the southerly located positions of Funchal, latitude 33°, and Havannah latitude 23°,] being in all months of the year nearly the same as at Kelung, Victoria and Manila, differ in summer little from those of Eastern Asia, but during the cold season they are in Siberia and Europe much greater.

During the summer, when the temperature of the air for vast distances in Asia and Europe is nearly the same, the irregular fluctuation of the barometric condition within the latitudes 30°-60° in Europe and Western and Eastern Asia is also everywhere nearly the same; but during the cold season it is, within the district of the air currents proceeding from the Atlantic Ocean, in Europe and Western Siberia, considerably greater than in Eastern Asia; where the cold and dry continental N., N.W. and W. winds dominate almost continually during the winter, and wet sea winds seldom cause disturbances by precipitation. Therefore, in Eastern Asia the systematic, periodical variations of the atmospheric pressure are generally extraordinary great, but the irregular variations of the barometric condition are, in relation to those of other countries, for example, Europe, small.

That is to say, the irregular non-periodic variations in the height of the barometer in ordinary times are but small; but there occur in Southern China and on the shores of Southern Japan extraordinarily great oscillations of the barometer when atmospheric disturbances, the so-called Typhoons, coming from the Ocean, touch the coast.

Typhoons appear only during the hot season. and must be considered as exceptional phenomenon; on an average scarcely one occurring within a year.

ANNUAL PERIOD.

NIKOLAJEVSK.

MONTHLY MEANS OF THE HEIGHT OF BAROMETER, CORRECTED TO 0° CELSIUS AND TO THE LEVEL OF THE SEA.—TABLE (196.)

	Jan.	Feb.	Mar.	Apr.	May	June
	mm.	mm.	mm.	mm.	mm.	mm.
1854 ...	......	......	......	......	......	......
1855 ...	760.6	758.1	761.8	759.4	756.0	751.1
1856 ...	764.2	766.8	760.8	762.5	756.1	754.5
1857 ...	756.7	758.5	759.3	758.9	757.5	755.3
1858 ...	761.2	760.3	759.6	759.5	753.5	......
1860 ...	762.7	759.7	764.3	753.4	758.0	754.9
1861 ...	760.8	757.3	759.4	758.1	754.9	753.1
1862 ...	761.3	757.1	761.1	753.2	756.0	751.6
1863 ...	755.3	755.6	759.0	754.2	750.5	750.2
1864 ...	756.9	757.8	761.7	755.7	754.0	753.6
1865 ...	758.8	761.2	757.4	756.6	752.4	750.9
1866 ...	759.0	759.5	758.0	757.3	757.2	757.1
1867 ...	759.6	763.7	754.4	754 5	754.5	750.8
1868 ...	758.6	762.0	760.3	754.6	755.3	753.6
1872 ...	755.1	757.3	757.3	758.8	756.8	755.2
1873 ...	759.1	757.5	757.5	756.2	755.2	756.4
Mean ...	759.3	759.9	759.2	756.6	755.4	753.4

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1854 ...	......	......	......	756.3	761.2	761.2	......
1855 ...	746.7	......	......	761.2	761.1	758.8	......
1856 ...	755.5	754.3	755.1	756.0	752.8	754.6	757.77
1857 ...	751.2	753.1	755.4	757.8	762.5	760.3	757.22
1858 ...	......	......	......	......	......	......	......
1860 ...	753.7	751.9	757.2	756.8	758.2	755.9	757.22
1861 ...	751.9	750.7	754.9	758.0	758.9	759.0	756.42
1862 ...	749.1	754.9	757.0	759.0	755.9	755.6	755.98
1863 ...	751.9	755.7	760.5	760.2	758.4	756.8	755.69
1864 ...	751.8	753.4	760.8	......	......	760.9	......
1865 ...	755.0	752.7	757.9	756.6	759.2	761.5	756.68
1866 ...	753.5	756.3	759.6	757.8	755.4	758.6	757.44
1867 ...	755.4	753.8	755.7	759.0	756.3	759.0	756.39
1868 ...	756.4	757.0	757.6	756.3	758.8	760.4	757.57
1872 ...	752.9	753.7	757.6	754.8	756.8	755.6	755.99
1873 ...	......	......	......	......	......	......	......
Mean ...	753.3	754.0	757.1	757.5	757.6	757.9	756.76

VLADIVOSTOK.

Besides the observations, contained in the table (207) and made during *one* year with an Aneroid barometer, whose corrections are not known, I possess observations, noticed by the Russian Archimandrite Palladius on a good Aneroid barometer, verified by myself at Peking. The place of observation has been the road of Vladivostok or its neighbourhood, and the time of observation daily once at 7 o'clock in the morning. I have calculated, by the help of our table (154) the following 24 hourly, monthly means, corrected for the errors of the instrument.

197	Jan.	Feb.	Mar.	Apr.	May	June	
	mm.	mm.	mm.	mm.	mm.	mm.	
1871 ...	768.2	767.2	762.4	758.0	756.4	756.0	
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean of Jan. and June.
	mm.	mm.	mm.	mm.	mm.	mm.	
1871 ...	756.2	756.9	......	......	......	......	762.1

Hence the annual mean of the atmospheric pressure at the sea-level of Vladivostok will be nearly 762.1 millimetres.

SI-WAN-TSE.

Observations made three times daily 7 a.m., 1 p.m. and 8 p.m. by means of two Aneroid barometers of the I. Russian Observatory, verified by myself.

MONTHLY MEANS.

198	Jan.	Feb.	Mar.	Apr.	May	June	
	mm.	mm.	mm.	mm.	mm.	mm.	
1873 ...	......	......	......	......	......	......	
1874 ...	663.5	662.7	661.8	658.9	656.4	656.5	
1875 ...	662.1	660.9	659.2	657.6	657.9	655.7	
Mean ...	662.8	661.8	660.5	658.3	657.1	656.0	
	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	
1873 ...	......	......	661.1	662.5	662.5	663.1	......
1874 ...	656.8	657.5	661.0	664.1	663.0	661.0	......
1875 ...	654.0	658.7	......	......	......	......	......
Mean ...	655.4	658.1	661.0	663.3	662.7	662.1	659.9

NEWCHWANG.

Observations, made during 1862 at sunrise and 3 p.m., and during 1872 at 4 a.m., 9 a.m., noon, 3 p.m. and 8 p.m., by means of Aneroid Barometers, as to whose corrections I have no information. The monthly means of the hours mentioned are as follows:—

199	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
1862 ...	773.7	770.8	768.9	762.3	761.9	757.6
1872 ...	776.4	776.3	768.0	765.2	760.3	760.1
Mean ...	775.0	773.5	768.5	763.7	761.1	758.8

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1862 ...	757.6	760.2	765.4	768.8	768.4	771.0	765.5
1872 ...	754.2	755.3	763.7	767.7	770.1	769.4	765.6
Mean ...	755.9	757.7	764.5	768.2	769.2	770.2	765.5

The annual Mean 765.5 is doubtless too great, for Newchwang is located 25—50 metres above the sea-level. For this reason I have inserted in table (207) the numbers of table (199), after having subtracted 5mm.

PEKING.

Observations, taken from my treatise "On the Climate of Peking":—

Monthly Means.

200	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
Mean of the years 1841—1849...	68 63	66.12	62.13	57.96	54.44	50.38
” ” 1850—1855...	67.80	67.19	62.36	57.81	53.05	49.60
” ” 1860, 61, 69, 70, 71, 72, 73, 74, ...	68.32	66.57	62.95	57.81	53.20	50.95
Mean....................................	68.25	66.63	62.48	57.86	53.56	50.31

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Mean of the years 1841—1849...	49.12	51.80	57.60	61.98	65.75	67.38	59.44
” ” 1850—1855...	48.29	51.60	57.03	62.99	66.67	68.20	59.38
” ” 1860, 61, 69, 70, 71, 72, 73, 74, ...	49.54	51.31	57.71	62.00	65.51	66.05	59.33
Mean....................................	48.98	51.57	57.45	62.32	65.98	67.21	59.38

TAKU.

Observations made on an Aneroid Barometer of the I. R. Peking Observatory, and verified several times within the period 1873—75 by comparison with the Quicksilver Barometer at Peking. Table (201) contains the means of the three hours—7 a.m., 1 p.m., and 9 p.m.

201	Jan.	Feb.	Mar.	Apr.	May.	June.	
	mm.	mm.	mm.	mm.	mm.	mm.	
1873......	772.4	768.4	766.5	759.4	756.5	755.0	
1974......	772.4	770.0	768.1	760.3	755.2	753.5	
1875......	771.0	769.8	764.4	760.5	758.0	753.5	
Mean ...	771.9	769.4	766.3	760.1	756.6	754.0	
	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1873......	752.4	755.2	760.5	764.6	767.3	770.1	762.4
1874	753.2	753.9	760.9	767.7	769.7	769.8	762.9
1675	751.6	756.4	760.5	765.9	769.1	771.6	762.7
Mean ...	752.4	755.2	760.6	766.1	768.7	770.5	762.65

SHANGHAI.

Observations made by means of good Quicksilver Barometers.

202 MONTHLY MEANS.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1865—1874...	770.4	768.9	766.1	762.8	758.6	756.5	754 6	755.7
1875—1876...	771.2	767.6	766.0	762.3	759.3	755.3	753.0	755.3

	Sept.	Oct.	Nov.	Dec.	Year.	Height above the sea.	No. of years observed.	
	mm.	mm.	mm.	mm.	mm.	m.		
1865—1674...	760.0	765.2	769.4	769.5	763.1	0	$3\frac{9}{12}$	Zeitschrift der Oest Gesl. fur Met. T. X.
1875—1876...	759.0	764.6	768.1	770.1	762.66	7	1	O'servatory at Zi-ka-wei.

The annual mean at the sea-level, according to the observations, made at Zi-ka-wei, 1875—1776, equals 762.66 +0.93=763.39mm. The annual mean Atmospheric Pressure at the sea-level near Shanghai, is therefore, by combining the observations 1865—1874 and 1875—1876 [table (202)], 763.2mm.

In "Sitzungsberichte der Wiener Akademie, Band 36," 1859, page 164, we find the following differences between the monthly

means and the annual mean of barometric condition, deduced from ten yearly observations, 1865—1874 and 1848—1852:

Jan.	Feb.	Mar.	Apr.	May.	June.
mm.	mm.	mm.	mm.	mm.	mm.
+7.9	+6.4	+3.2	—0.8	—4.6	—7.7

July.	Aug.	Sept.	Oct.	Nov.	Dec.
mm.	mm.	mm.	mm.	mm.	mm.
—9.5	—8.4	—2.7	+2.4	+6.5	+7.3

Adding these differences to the annual mean 763.2, we have the monthly and annual means of Atmospheric Pressure at the sea-level:

203	Jan.	Feb.	Mar.	Apr.	May.	June.	
	mm.	mm.	mm.	mm.	mm.	mm.	
	771.1	769.6	766.4	762.4	758.6	755.5	
	July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**	**Year.**
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
	753.7	754.8	760.5	765.6	769.7	770.5	763.2

YEDO.

Observations made by Erwin Knipping, Esq., on a siphon-barometer, Greiner No. 426. The monthly means of the hours 7 a.m., 2 p.m. and 9 p.m. are :—

204	Jan.	Feb.	Mar.	Apr.	May	June	July
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1872 ...	......	......	......	......	......	......	......
1873 ...	762.5	761.7	764.0	763.0	760.2	759.2	758.8
1874 ...	764.2	763.9	763.6	760.9	760.6	759.7	758.9
Mean ...	763.3	762.8	763.8	762.0	760.4	759.4	758.8

	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	Height a've the sea-level.
	mm.	mm.	mm.	mm.	mm.	mm.	m.
1872 ...	......	......	763.9	765.5	764.1	......	......
1873 ...	760.0	759.9	763.2	763.3	764.0	......	......
1974 ...	759.2	760.4	......	......	......	......	......
Mean ...	759.6	760.1	763.5	764.4	764.1	761.9	5

YOKOHAMA.

Observations, taken from "Zeitschrift der Oesterreichischen Gesellschaft fur Meteorologie T. VII page 47 and page 361." Monthly means.

205	Jan.	Feb.	Mar.	Apr.	May	June	July
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1865 ...	761.8	762.4	764.5	761.1	760.3	757.5	755.3
1870 ...	760.9	762.3	761.1	761.2	760.4	757.6	756.4
Mean ...	761.3	762.3	762.8	761.2	760.3	757.6	755.8

	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	Height above the sea.
	mm.	mm.	mm.	mm.	mm.	mm.	m.
1865 ...	758.2	761.5	761.5	764.2	767.3	761.3	3
1670 ...	756.0	759.0	761.5	765.5	759.8	760.1	not known, probable some metres.
Mean ...	757.1	760.3	761.5	764.8	763.5	760.7	

KELUNG.

During 1873 and 1874 observed by means of an Aneroid Barometer, verified by me at Peking; and in 1875 by means of a quicksilver Barometer, constructed by the mechanician Falconer.

MONTHLY MEANS OF 7 A.M., 1 P.M. AND 9 P.M.

206	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
1873 ...	......	......	......	......	......	......
1874 ...	767.1	764.9	762.9	761.5	755.2	754.7
1875 ...	765.5	764.9	762.8	760.4	757.9	754.0
Mean ...	766.3	764.9	762.8	760.9	756.5	754.3

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
1873 ...	......	......	750.0	757.9	762.0	762.9	
1874 ...	751.8	752.3	754.7	760.0	765.7	765.2	
1875 ...	751.3	......	......	......	......	......	
Mean ...	751.5	752.3	752.4	759.0	763.8	764.0	759.1

MEAN MONTHLY ATMOSPHERIC PRFSSURE.

CONTINENT OF EASTERN ASIA.—TABLE (207).

Millimetres, corrected to 0 Celsius.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	Height above the sea-level Metres.	No. of years observ'd.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.			
Yakutsk	759 3	760.8	755.6	752.3	748.5	745.8	746 3	747 6	754.6	753.6	757.6	763.4	753.8	87	$1\frac{8}{12}$	A. Buchan, the mean Pressure of the Atmosphere etc., pag. 603.
Ayan	756.6	758.2	760.4	759.9	755.5	754.1	752.7	755.7	756.0	758 3	758 0	753.2	756.5	.....	4	Zeitschrift der Oesterr. Ges. fur Meteorologic, T. V. p. 42.
Udskoi	762 0	758.5	756.0	756.0	751.5	750.5	748.4	747.0	751.0	753.1	756.6	758.4	754.1	....	1	A. Buchan, the mean Pressure of the Atmosphere 603.
Nicolajevsk	759.3	759.9	759.2	756.6	755.4	753.4	753 3	754.0	757.1	757.5	757.6	757.9	756.8	0	11	Schrenck, Amur-Reise, T. IV pag. 356.
Nerchinsk	710.2	709.2	708.0	702.6	701.1	700.1	700.1	702.2	704.8	706.9	707.5	707.3	705.0	592	18	Zeitschrift der Oeste-. Ges. fur Meteorologie, T. V. p. 42.
Vladivostok	764.6	764.7	759.9	761.5	756.3	758.8	753.4	753.4	760.4	759.9	761.7	762.2	759.7	....	1	Schrenck, Amur-Reise, p. 356, T. IV.
Si-wan-tse	662.8	661.8	660.5	658.3	657.1	656.1	655.4	658.1	661.0	663.3	662.7	662.1	659.9	119.5	2	Table (198.)
Kalgan	695.3	695.6	....	....	....	....	....	685.1	689.8	692 8	693.2	695.3	....	826	....	1873, 7 a m., 1 p.m., 9 p.m.
Newchwang	770.0	768.5	763.5	758.7	756.1	753.8	750.9	752.7	759.5	763.2	764.2	765.2	760.5	....	2	Table (199) minus 5.0 mm.
Peking	768.2	766.6	762.6	757.9	753.6	750.3	749.0	751.6	757.4	762.3	766.0	767.2	759.4	37.5	23	Table (200.)
Tientsin	772.6	772.2	764.1	762.6	758.0	756.1	750.9	755 1	760.4	764.6	766.5	766.5	762.5	2	1	1873, mean of 7 a.m., 1 p.m. and 9 p.m.
Taku	771.9	769.4	766.3	760.1	756.6	754.0	752.4	755.2	760 6	766.1	768.7	770.5	762.7	6	3	Table (201.)
Chefoo	769.9	....	....	....	....	....	756.0	758 6	764.1	768.1	770.5	773.2	....	....	$\frac{7}{12}$	1871-72; Mean of 10 a.m., 4 p.m. and Midnight.
Shanghai	771.1	769.6	766.4	762.4	758.6	755.5	753.7	754.8	760.5	765.6	769.7	770 5	763.2	0	10	Table (203.)
Fu-cheu-foo	....	....	....	760.9	758.3	756.4	753 6	764.5	768.7	772.5	777.5	777.8	....	....	$\frac{9}{12}$	Mean of 9 a.m. and 3 p.m.
Canton	768.1	766.3	764.8	761.0	759.2	758.7	756.9	756.9	757.4	762.7	766.3	767.1	762.1	11	10	Zeitschrift der Oester. Gesellsch. fur Meteorol. T. VIII p. 219.
Saigon..........	761.6	761.8	761.7	761.0	760.8	759.4	760.0	759.5	759.9	758.3	762.3	763.2	760.8	....	1	" " " " T. VII p. 23.
Bangkok.........	762.6	762.1	761.1	759.9	757.4	757.0	757.0	757.2	757.6	758.9	761.2	761.8	759.5	....	4	" " " " "

ISLANDS OF EASTERN ASIA.—TABLE (208).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	Height above the sea-level Metres.	No of years observed.	
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.			
Petropaulovsk ..	746.9	750.5	754.3	760.0	757.0	755.1	753.9	754 7	754.6	752.5	751.8	754 8	753.8	....	1	A. Buchan, The mean Press., etc., p. 602
Dui	750 1	748 8	747 7	745.8	745 9	746.2	746.1	746 2	748.3	749 3	747.0	748.9	747.5	100?	2	Schrenck, Amur-Reise T. IV.
Hakodate	755.9	757.8	760.0	757.5	755.5	752.8	752.7	753.4	756.0	758.5	758.7	759.3	756.5	9	$4\frac{6}{12}$	Zeitschrift der Oesterr. Gesellsch. fur Meteorol. T. V. p. 42.
Yedo	763.3	762.8	763.8	762.0	760.4	759.4	758 8	759.6	760.1	763.5	764.4	764.1	761.9	5	2	Table (204.)
Yokohama	761.3	762.3	762.8	761.2	760.3	757.6	755 8	757.1	760.3	761.5	764.8	763.5	760.7	3?	2	Table (205.)
Osaka	763.7	764.4	762 3	761.3	759.5	756.4	756.1	758 0	759 5	762.0	765.8	763.7	761 1	....	1	Zeitschrift der Oesterr. Gesells. fur Met. T. VI p. 251.
Decima	766.4	765.2	764.5	761 5	759.1	756.5	756 6	755.6	758.7	762 8	765 6	766.3	761.6	8	7	18[illegible]5-55 cf. Meteorol. Waarnemingen in Nederland, etc., 1856.
Nafa	764.2	764.0	763.6	761.8	758,6	757.0	756.4	753 8	756.5	759.9	763.6	764.9	760.4	10	$1\frac{10}{12}$	Zeitschrift der Oesterr. Gesells. fur Met. T. VII p. 4[illegible].
Kelung	766.3	764.9	762.8	760.9	756.5	754 3	751.5	752.3	752.4	759.0	763.8	764.0	759.1	15	2	Table (206.)
Victoria	766.3	765.3	763.6	760.7	758.5	756.2	755.0	754.8	756.7	761.3	764.8	765.7	760.7	17	$2\frac{4}{12}$	Zeitschrift der Oesterr. Gesells. fur Met T. VIII p. 219.
Victoria Peak ..	720.3	720.5	719.3	717.8	715 9	715.4	714 6	714.5	714.9	717 8	720.1	720.8	717.7	532	$2\frac{4}{12}$	" " " " " "
Manila	757.2	756.8	756.6	755.3	754.9	754,0	753.5	753.1	752.0	754.8	755.7	756.4	755.0	33	5	" " " " " p. 334.

MONTHLY RANGE OF ATMOSPHERIC PRESSURE.

Differences between the Monthly and Annual Means of the Tables (207) *and* (208.)

CONTINENT OF EASTERN ASIA.—TABLE (209.)

	Jan. mm.	Feb. mm.	Mar. mm.	Apr. mm.	May. mm.	June. mm.	July. mm.	Aug. mm.	Sept. mm.	Oct. mm.	Nov. mm.	Dec. mm.	Annual Mean. mm.	Annual Amplitude. mm.	No. of years observed.
Yakutsk	+ 5.5	+7.0	+1.8	—1.5	—5.3	—8.0	— 7.5	—6.2	+0.8	—0.2	+3.8	+9.6	753.8	17.6	$1\frac{8}{12}$
Ayan	+ 0.1	+1.7	+3.9	+2.7	—1.0	—2.4	— 3.8	—0.8	—0.5	+1.8	+1.5	—3.3	756.5	7.7	4
Udskoi	+ 7.9	+4.4	+1.9	+1.9	—2.6	—3.6	— 5.7	—7.1	—3.1	—1.0	+2.5	+4.3	754.1	15.0	1
Nikolajevsk	+ 2.5	+3.1	+2.4	—0.9	—1.4	—3.4	— 3.5	—2.8	+0.3	+0.7	+0.8	+1.1	756.8	6.6	11
Nerchinsk	+ 5.2	+4.2	+3.0	—2.4	—3.9	—4.9	— 4.9	—2.8	—0.2	+1.9	+2.5	+2.3	705.0	10.1	18
Vladivostok	+ 4.9	+5.0	+0.2	+1.8	—3.4	—0.9	— 6.3	—6.3	+0.7	+0.2	+2.0	+2.5	759.7	11.3	1
Si-wan-tse	+ 2.9	+1.[illegible]	+0.6	—1.6	—2.8	—3.8	— 4.5	—1.8	+1.1	+3.4	+2.8	+2.2	659.9	7.9	2
New-chwang	+ 9.5	+8.0	+3.0	—1.8	—4.4	—6.7	— 9.6	—7.8	—1.0	+2.7	+3.7	+4.7	760.5	19.1	2
Peking	+ 8.8	+7.2	+3.1	—1.5	—5.8	—9.1	—10.4	—7.8	—2.0	+2.9	+6.6	+7.8	759.4	19.2	23
Tientsin	+10.1	+9.[illegible]	+1.6	+0.1	—4.5	—6.4	—11.6	—7.4	—2.1	+2.1	+4.0	+4.0	762.5	21.7	1
Taku	+ 9.2	+6.[illegible]	+3.6	—2.6	—6.1	—8.7	—10.3	—7.5	—2.1	+3.4	+6.0	+7.8	762.7	19.5	3
Shanghai	+ 7.9	+6.[illegible]	+3.2	—0.8	—4.6	—7.7	— 9.5	—8.4	—2.7	+2.4	+6.5	+7.3	763.2	17.4	10
Canton	+ 6.0	+4.2	+2.7	—1.1	—2.9	—3.4	— 5.2	—5.2	—4.7	+0.6	+4.2	+5.0	762.1	11.2	10
Saigon	+ 0.8	+1.[illegible]	+0.9	+0.2	0.0	—1.4	— 0.8	—1.3	—0.9	+2.5	+1.5	+2.4	760.8	4.9	1
Bangkok	+ 3.1	+2.[illegible]	+1.6	+0.4	—2.1	—2.5	— 2.5	—2.3	—1.9	—1.6	+1.7	+2.3	759.5	5.6	4

ISLANDS OF EASTERN ASIA.—TABLE (210.)

	Jan. mm.	Feb. mm.	Mar. mm.	Apr. mm.	May. mm.	June. mm.	July. mm.	Aug. mm.	Sept. mm.	Oct. mm.	Nov. mm.	Dec. mm.	Annual Mean. mm.	Annual Amplitude. mm.	No. of years observed.
Petropaulovsk	—6.9	—3.5	+0.5	+6.2	+3.2	+1.3	+0.1	+0.9	+ 0.8	—1.3	—2.0	+1.0	753.8	13.1	1
Dui	+2.6	+1.3	+0.2	—1.7	—1.6	—1.3	—1.4	—1.3	+0.8	+1.8	—0.5	+1.4	747.5	4.3	2
Hakodate	—0.6	+1.3	+3.5	+1.0	—1.0	—3.7	—3.8	—3.1	—0.5	+2.0	+2.2	+2.8	756.5	7.3	$4\frac{1}{2}$
Yedo	+1.4	+0.9	+1.9	+0.1	—1.5	—2.5	—3.1	—2.3	—1.8	+1.6	+2.5	+2.2	761.9	5.6	2
Yokohama	+0.6	+1.6	+2.1	+0.5	—0.4	—3.1	—4.9	—3.6	—0.4	+0.8	+4.1	+2.8	760.7	7.7	2
Osaka	+2.6	+3.3	+1.2	+0.2	—1.6	—4.7	—5.0	—3.1	—1.6	+0.9	+4.7	+2.6	761.1	9.7	1
Decima	+4.8	+3.[illegible]	+2.9	—0.1	—2.5	—5.1	—5.0	—6.0	—2.9	+1.2	+4.0	+4.7	761.6	10.8	7
Nafa	+3.8	+3.6	+3.2	+1.4	—1.8	—3.4	—4.0	—6.6	—3.9	—0.5	+3.2	+4.5	760.4	11.1	$1\frac{10}{12}$
Kelung	+7.2	+5.8	+3.7	+1.8	—2.6	—4.8	—7.6	—6.8	—6.7	—0.1	+4.7	+4.9	759.1	14.8	2
Victoria	+5.6	+4.6	+2.9	0.0	—2.2	—4.5	—5.7	—5.9	—4.0	+0.6	+4.1	+5.0	760.7	11.5	$2\frac{1}{3}$
Victoria Peak	+2.6	+2.8	+1.6	+0.1	—1.8	—2.3	—3.1	—3.2	—2.8	+0.1	+2.4	+3.1	717.7	6.3	$2\frac{1}{3}$
Manila	+2.2	+1.8	+1.6	+0.3	—0.1	—1.0	—1.5	—1.9	—3.0	—0.2	+0.7	+1.4	755.0	5.2	5

According to the tables (207)—(210), for the greatest number of our places the barometer stands lowest during the summer and highest during the winter; and the absolute values of height of barometer at different places, reduced to the sea-level, during the summer differ from each other only some millimetres, but during the winter very much. This is not difficult to explain.

The dry continent of Asia becomes during the summer of the northern hemisphere hotter than the surrounding oceans, an ascending current of air rises over the continent, carrying away a part of the air.

In this manner the barometer descends in spring; when the sun ascends over Asia, in Central Asia appears the central region of a vast cyclone, causing an inflow from the surrounding oceans to the central region in tracks curved opposite to the daily course of the sun (cf. chart). But the air, coming from the ocean and saturated with aqueous vapour, being in its specific gravity lighter than the dry air, cannot completely compensate for the discharge into the higher regions; therefore, the barometer descends until July, when the heat of the Asiatic continent reaches its maximum, and the ascending current its greatest intensity. As on the continent, then, the temperature and pressure of aqueous vapour change very little with the geographical position, during the summer the absolute values of the barometric heights at the sea-level also vary for all Eastern Asia only some millimetres, and are all not distant from 753 millimetres.

The annual minimum of the Atmospheric Pressure in Eastern Asia occurs therefore at the time of the maximum of temperature and pressure of aqueous vapour.

The annual maximum of the Atmospheric Pressure occurs in Eastern Asia in January.

As the sun from summer to the autumn and winter, begins to sink, the continent becomes cooler; it radiates through a clear sky more warmth to space than it receives during the short presence of the low sun over the horizon. In consequence the lowest stratum of the air, covering and touching the continent, becomes cold and contracted. In order to fill up the chasm the air falls down from above; *i.e.* it produces the central region of an anti-cyclone, where calms reign, *i.e.* absence of horizontal air currents. In consequence of the low temperature and the dryness of the continental air, the barometric condition within the central region of the above-mentioned anti-cyclone in January is very high, the highest during the whole year. The annual maximum of the Atmospheric Pressure occurs also at the time of the minimum of the temperature and of the pressure of aqueous vapour.

With regard to the place and the extent of the anti-cyclone; its central region during January is a little to the south of Lake Baikal and embraces, besides other countries, the whole of Eastern Asia as far as the meridian of 145°. To the East of this meridian, on the most northern part of the Pacific Ocean at the same time (January) exists the central region of a cyclone (in the central region of a cyclone the air ascends from the surface of the earth), within whose sphere of activity is found the greatest part of the sea of Okhotsk.

During the summer, when the place of the anti-cyclone of winter on the continent is occupied by a cyclone, and on the Pacific Ocean the place of the winter cyclone is occupied by an anti-cyclone—because in summer the ocean is cooler than the land—the Atmospheric Pressure has in the whole of Eastern Asia, continent and islands included, its annual minimum; and on the northern part of the Pacific Ocean and Kamschatka, easterly from the meridian 145°, its maximum. During the winter the continent and islands of Eastern Asia have their annual barometric maximum, and the northern part of the Pacific and Kamschatka, easterly from the meridian of 145°, their minimum.

Between these two systems, near the meridian of 145° lies a region, in which the Atmospheric Pressure changes very little during the whole year.

The annual amplitude of the Atmospheric Pressure reduced to the sea-level is greater within the central region of the Asiatic winter anti-cyclone than in any of the adjacent countries, amounting to about 25mm, (as table 209 shows, the amplitude decreasing as the height over the sea increases). From this central region, situated near the Lake Baikal, the annual amplitude diminishes in all directions.

At Yakutsk, it is only 18mm., on Saghalin and Yesso about 5mm., at Peking 19mm., in Southern Japan 10mm., at Canton 11mm., and at Manila only 5mm.

The excellent charts of isobaric lines, constructed by A. Buchan help to a good understanding of the distribution of the atmospheric pressure in Eastern Asia.

In order to decide, to what degree of exactness these charts indicate the absolute barometric conditon, I have selected those of our stations, which are situated near the sea and where the observations have been made with good and verified instruments, and have compared the observed barometric heights with the heights of Buchan's charts.

The reduction of the observed barometric heights to the sea-level is made on the hypothesis, that the barometric height increases 0.0905 millimetres, as the height over the sea-level decreases 1 metre.

NIKOLAJEVSK.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	759.0	760.0	759.0	757.0	755.0	753.0	753.0	754.0	757.0	757.0	758.0	758.0	756.8	11 {Reduced to sea-level.
Buchan's Charts ...	759.0	760.0	760.0	759.0	758.0	755.0	754.0	756.0	758.0	759.0	759.0	759.5	757.8	
Differences	0	0	—1.0	—2.0	—3.0	—2.0	—1.0	—2.0	—1.0	—2.0	—1.0	—1.5	—1.0	

VLADIVOSTOK.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.					mm.	
Observation	768.0	767.0	762.0	758.0	756.0	756.0	756.0	757.0	......	......	......	......	762.1	$\frac{8}{12}$ {Reduced to sea-level; compared with the Standard-Barometer at Peking.
Buchan's Charts ...	764.0	764.0	763.0	761.0	759.0	755.0	754.0	756.0	......	.....	......	......	761.5	
Differences	+4	+3	—1	—3	—3	+1	+2	+1	......	......	......	......	+0.6	

PEKING.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	771.6	770.0	765.9	761.3	757.0	753.7	752.4	755,0	760.8	765.7	769.4	770.6	762.8	23 {Reduced to sea-level; compared with the Standard Barometer at St. Petersburg.
Buchan's Charts ...	770.8	769.1	764.5	759.4	756.3	752.3	751.3	753.3	759.4	762.0	767.1	769.6	762.0	
Differences	+0.8	+0.9	+1.4	+1.9	+0.7	+1.4	+1.1	+1.7	+1.4	+3.7	+2.3	+1.0	+0.8	

TAKU.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	772.4	769.9	766.8	760.6	757.1	754.7	752.9	755.7	761.1	766.6	769.2	771.0	763.2	3 { Reduced to sea-level; compared with the Standard Barometer at Peking.
Buchan's Charts ...	770.0	769.1	764.5	759.8	756.9	753.0	752.0	754.1	759.4	762.0	767.1	769.6	762.0	
Differences	+2.4	+0.8	+2.3	+0.8	+0 2	+1.5	+0.9	+1.6	+1.7	+4.6	+2.1	+1.4	+1.2	

SHANGHAI.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	771.1	769.6	766.4	762.4	758.6	755.5	753.7	754.8	760.5	765.6	769.7	770.5	763.2	10 { Reduced to sea-level.
Buchan's Charts ...	771.1	767.6	764.5	760.7	757.9	754.4	754.4	754.8	759.5	762.0	767.1	767.1	762.0	
Differences	0.0	+2.0	+1.9	+1.7	+0.7	+1.1	—0.7	0.0	+1.0	+3.6	+2 6	+3.0	+1.2	

YEDO.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	763.8	763.3	764.3	762.5	760.9	759.9	759.3	760.1	760.6	764.0	764.9	764.6	762.4	2 { Reduced to sea-level.
Buchan's Charts ...	765.0	764.5	764.4	762.0	759.8	757.2	756.9	756.5	760.2	762.0	764.5	763.0	761.5	
Differences	—1.2	—1.2	—0.1	+0.5	+1.1	+2.7	+2.4	+3.6	+0.4	+2.0	+0.4	+1.6	+0.9	

DECIMA.

	Jan.	Feb.	Mar.	Apr.	May.	June	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	767.1	765.9	765.2	762.2	759.8	757.2	757.3	756 3	759.4	763.5	766.3	767.0	762.3	10 { Reduced to sea-level.
Buchan's Charts...	769.4	765.8	764.5	762.0	759.0	756 2	755.7	755.7	759.9	762.0	766.2	764.5	762.0	
Differences	—2.3	+0.1	+0.7	+0.2	+0.8	+1.0	+1.6	+0.6	—0.5	+1.5	+0.1	+2.5	+0.3	

KELUNG.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Observation	767.7	766.3	764.2	762.3	757.9	755.7	752.9	753.7	753.8	760.4	765.2	765.4	760.5	$1\frac{11}{12}$ { Reduced to sea-level; compared with the Standard Barometer at Peking.
Buchan's Charts...	767.1	765.1	764.5	760.3	758.2	755.4	755.5	755.0	759.4	769.0	765.8	766.3	762.0	
Differences	+0.6	+1.2	—0.3	+ 0.2	—0.3	+ 0.3	—2.6	—1.3	—5 6	—1.6	—0.6	—0.9	—1.5	

According to the above comparison the error of Buchan's charts of isobaric lines for the coasts and islands of Eastern Asia is on an average 1 millimetre.

Observations, taken by myself during a sea voyage from Shanghai to Singapore in the year 1875, have resulted in a correction of Buchan's charts equal to 2 millimetres, but it must be remarked, that these observations embrace only two weeks.

Having regard to the exactness of Buchan's charts I have not constructed special charts of isobaric

lines for Eastern Asia. The absolute variability of the monthly means of the Atmospheric Pressure from year to year is at Nikolajevsk and Peking as follows:—

211	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.	No. of years observed.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
Nikolajevsk...	9.1	11.2	9.9	9.3	7.5	6.9	9.7	6.3	5.9	6.4	7.1	6.9	2.1	11
Peking	5.2	6.2	7.2	5.6	5.3	5.6	4.6	4.2	3.3	5.3	6.2	9.4	3.3	23

These quantities (of table 211) are as small in comparison with those of other countries as are the differences of the absolute extremes of the barometric condition exhibited in tables (193) and (194), and as the absolute variability of the monthly means of the temperature exemplified in tables (125)-(127).

For instance at St. Petersburgh the absolute variability of the monthly means of the Atmospheric Pressure is as follows:—

Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
30.0	18.8	21.6	15.2	9.4	10.2	9.1	14.8	13.8	21.3	26.7	27.2	6.0

IV.—WINDS.

DAILY PERIOD.

As I have stated in the preceding chapter, according to Buchan's charts of isobaric lines, during the summer of the northern hemisphere the central region of a cyclone exists in central Asia, within which the air ascends from the earth's surface; and during the winter also in central Asia exists the central region of an anti-cyclone, within which the air descends and flows off in all directions horizontally. It thence follows, that Asia, in regard to the (annual) influence of the sun on the barometric condition and the motion of the Atmosphere, is a great island, whose frontier is indicated by the Arctic, Pacific and Indian Oceans, the Gulf of Persia and the Caspian Sea.

While this island, in its middle, on the parallel of 40°, from East to West extends only about 4 hours of longitude and the temperature near the time of the daily maximum changes little with the time, Asia, regarded as a whole, will have reached at about 4½ o'clock in the afternoon, mean time of Peking, its daily maximum of temperature; and then in central Asia the central region of a daily cyclone will be formed. To this point flows the air of all places situated on the periphery of the cyclonic central region, excepting only those countries which lie near or on peninsulas or islands.

The central region of the daily cyclone of Asia will have a motion from East to West, corresponding to the daily motion of the sun in the same direction, analogous to the great summer cyclone of Asia, which arises at first in April over India, and thence, with the progress of the season, extends and advances to the N.. until it reaches in July its most northern position about the parallel of 40°.

In autumn it goes back to the South, and disappears in October.

In October the winter anti-cyclone commences to form and the annual barometric maximum to appear, upon which depends during the months of November, December, January, February and March the system of winds in Asia.

Analogous to this contrast between summer and winter is that also between day and night.

After the daily cyclone an anti-cyclone is probably formed near the same region during the night; but unfortunately we possess no observations on the latter, the anti-cyclone. Upon each peninsula and island during the first hours of the afternoon of each day the central region of an independent and almost immovable cyclone appears, towards and around which the air flows in orbits, curved contrary to the daily course of the sun, in order to ascend there. During the night an almost immovable, independent anti-cyclone arises, in whose central region the air descends and flows off horizontally on all sides in orbits, curved in accordance with the daily course of the sun.

While these daily cyclones and anti-cyclones of the peninsulas and islands are distinctly separated from the great daily cyclone and anti-cyclone of the whole continent of Asia; there exist, excepting the great summer cyclone of the continent, no independent, distinctly expressed summer cyclones on the peninsulas and islands; and, excepting the great winter anti-cyclone, no winter anti-cyclones on the peninsulas and islands.

This is proved by the appended wind-charts of the summer

and winter, where the existence of independent annual cyclones and anti-cyclones on the peninsulas and islands will be discovered only by some deviations of the direction of the wind from the course of the air *en gros*, indicated on our charts by long arrows.

That the daily cyclones of the peninsulas and islands in Eastern Asia exist independently of the daily cyclone of the Asiatic continent, I will now demonstrate by means of the following tables (212)-(216).

Places, for which we possess observations on the frequency of the winds at different hours of the day, and which belong to the inner Asiatic daily cyclone, are Blagoveshchensk, Peking and Taku.

Blagoveshchensk lies within the central region of the inner Asiatic cyclone itself, consequently, according to the table (213), the daily period of the winds consists in a greater perturbation during the first hours of the afternoon, the warmest time of the day, than in the morning and the evening; the number of observed calms in the first hours of the afternoon being smaller than in the morning and evening, and the number of *all* winds having been amplified by the increase of the daily temperature.

Peking and Taku are situated on the eastern side of the great daily cyclone of Central Asia. According to our observations, table (214), from morning to evening the number of N., N.E. and N.W. winds decreases, and the number of the S.E., S. and S.W. winds increases. E. and W. winds, during the first hours of the afternoon are a little more numerous than in the morning and evening; but their absolute number is insignificant, so that they are of no importance.

The mean direction of the wind, produced by the sun in the afternoon is therefore from S. to N. Thence we learn, that besides the central Asiatic cyclone, the daily period of the winds at Peking is also influenced by the daily cyclone of the peninsula of Corea; for, if the former alone affected it, the direction of the wind in the afternoon should be from S.E. to N.W.

The daily period of the wind at the neighbouring station of Taku, situated immediately on the coast of the Gulf of Petchili resembles that at Peking.

There [cf. table (215)], from the morning till the afternoon the number of *all* winds decreases; only S.E. and E., the most frequent winds at Taku, increase.

That is partly produced by the great cyclone of the Asiatic continent, and partly by the immediate vicinity of the sea, the Gulf of Petchili.

Nikolajevsk, on the left bank of the Amoor river is an example of a place, lying on a peninsula. The centre of the peninsula formed by the sea of Okhotsk, the Gulf of Ulbanj, the Amoor-Liman and the Amoor river, is situated N.W. from Nikolajevsk; hence, in accordance with our table (212), the observed number of S.E., S.W. and W. winds must from sunrise to afternoon increase, and the number of N. and N.W. winds during the same time decrease.

And last, the observations at the lighthouse of Dui, constructed on the western coast of the island Saghalin, prove that the centre of its daily cyclone lies to the East, in the interior of Saghalin; because, according to table (216), during the first hours of the afternoon the N., S.W., W. and N.W. winds reach their daily maximum of frequency, and their number is then greater than in the morning near sunrise, and in the evening, near sunset.

The following observations of the frequency of the direction of the wind and calms, tables (212)-(245), are reduced, so that the monthly sum of all winds N., N.E., E., S.E., S., S.W., W., N.W. and calms is equal to one thousand.

NIKOLAJEVSK.

Daily period of the number of winds. 1,000 observations every month. 8 years, 1857, 1858, 1859, 1860, 1861, 1862, 1863 and 1865.

212	N.			N.E.			E.			S.E.			S.		
	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.
Winter	156	61	177	46	25	58	20	22	23	14	15	12	2	1	2
Spring	89	54	118	128	114	218	178	148	176	137	200	137	8	9	10
Summer	89	80	111	114	133	165	193	199	197	211	316	256	6	18	4
Autumn	127	71	142	120	116	119	62	83	67	49	77	62	3	5	3
Year, Sum ...	461	266	548	408	388	560	448	452	463	411	608	467	19	33	19

	S.W.			W.			N.W.			Calm.		
	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.	7 a.m.	2 p.m.	10 p.m.
Winter	73	149	71	294	451	265	361	260	306	33	17	86
Spring	125	185	51	112	174	86	151	101	93	77	15	111
Summer	118	73	25	53	73	36	129	80	94	86	28	113
Autumn	63	137	44	225	253	177	304	238	275	49	19	110
Year, Sum	379	544	191	684	951	564	945	679	768	245	79	420

BLAGOVESHCHENSK.

Daily period of the number of winds. Mean of 2 years, 1860-61. 1,000 observations every month. 12,000 observations in the whole year.

213

	Annual Sum. 7 a.m.	2 p.m.	10 p.m.		Annual Sum. 7 a.m.	2 p.m.	10 p.m.		Annual Sum. 7 a.m.	2 p.m.	10 p.m.
N.	147	211	99	S.E.	84	130	27	W.	27	54	39
N.E.	28	22	0	S.	106	257	60	N.W.	588	624	264
E.	66	43	31	S.W.	49	107	61	Calm	2905	2552	3419

PEKING.

Daily period of the number of winds and calms. 17 yearly observations, 1841-55 and 1872-73; 1,000 observations every month.

214

	N.			N.E.			E.			S.E.			S.		
	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.
Winter	205	120	79	91	89	38	10	25	9	17	58	39	33	87	87
Spring	134	67	59	110	81	33	24	30	15	59	113	120	80	226	279
Summer	182	103	65	130	113	53	35	55	39	71	136	133	81	183	204
Autumn	205	114	75	93	86	40	14	35	18	32	83	57	33	137	157
Year	726	404	278	424	369	164	83	145	81	179	390	349	227	633	727

	S.W.			W.			N.W.			Calm.		
	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.	7 a.m.	1 p.m.	9 p.m.
Winter	39	118	130	26	33	33	301	295	225	285	155	373
Spring	75	158	141	23	25	17	200	199	157	292	100	183
Summer	48	97	101	14	16	7	125	103	80	317	191	318
Autumn	47	123	141	33	36	34	260	237	165	283	146	316
Year	209	496	513	96	110	91	886	834	627	1177	592	1190

TAKU.

Daily period of the number of winds and calms. 3 years, 1873-75; 1,000 observations every month.

215	Annual Sum.				Annual Sum.				Annual Sum.		
	7 a.m.	1 p.m.	9 p.m.		7 a.m.	1 p.m.	9 p.m.		7 a.m.	1 p.m.	9 p.m.
N.	292	139	117	S.E.	366	843	1066	W.	452	384	311
N.E.	559	475	432	S.	432	245	359	N.W.	694	692	450
E.	366	505	592	S.W.	839	717	673	Calm	0	0	0

DUI.

Daily period of the number of winds and calms. 2 years, 1864 and 1865; 1,000 observations every month.

216	Annual Sum.				Annual Sum.				Annual Sum.		
	7 a.m.	2 p.m.	10 p.m.		7 a.m.	2 p.m.	10 p.m.		7 a.m.	2 p.m.	10 p.m.
N.	547	1057	463	S.E.	1196	469	1333	W.	116	329	160
N.E.	359	244	338	S.	567	586	559	N.W.	437	641	319
E.	405	124	576	S.W.	159	391	127	Calm	214	159	125

ANNUAL PERIOD.

YAKUTSK.

Observations taken from A. Buchan, "The Mean Pressure of the Atmosphere, etc., page 621." 15 years, 1829-44, daily observed 7 a.m.

217	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	290	32	0	0	65	0	32	32	549
Feb.	214	36	36	0	71	0	36	36	571
Mar.	161	32	32	0	97	0	65	65	548
Apr.	200	33	33	33	100	33	100	68	400
May	161	32	97	32	97	32	129	65	355
June	100	33	133	67	100	33	100	33	401
July	97	32	97	65	161	32	97	32	387
Aug.	129	32	97	32	97	32	97	65	419
Sept.	134	33	67	33	100	33	100	67	433
Oct.	161	32	32	32	97	32	97	65	452
Nov.	267	33	33	0	33	0	33	33	568
Dec.	290	32	0	0	65	0	32	32	549
Mean	184	33	55	25	90	19	76	49	469

AYAN.

Taken from A. Buchan, "The Mean Pressure of the Atmosphere, etc., page 622." 2 years, August, 1847 to September, 1849 at 7 a.m., 2 p.m. and 9 p.m.

218	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	97	97	32	97	161	258	32	32	194
Feb.	107	178	71	36	71	107	71	36	323
Mar.	65	355	32	32	97	97	0	32	290
Apr.	67	300	33	33	167	133	0	33	234
May	97	323	32	0	97	161	32	0	258
June	67	333	33	0	67	267	67	0	166
July	32	323	97	0	32	226	32	32	226
Aug.	65	258	65	0	65	258	32	0	257
Sept.	0	433	67	0	67	167	33	0	233
Oct.	97	194	32	32	65	161	32	65	322
Nov.	100	200	33	67	100	133	100	67	200
Dec.	65	258	32	65	97	258	32	65	128
Mean	72	271	47	30	90	185	39	30	236

NIKOLAJEVSK.

14 years; 1857, 1858, 1859, 1860, 1861, 1862, 1863, 1865, 1866, 1867, 1868, 1869, 1871 and 1872; 7 a.m., 2 p.m. and 10 p.m.

219	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	92	22	20	5	1	66	469	270	55
Feb.	86	42	40	12	2	63	402	289	64
Mar.	96	102	136	50	5	86	263	163	99
Apr.	52	112	217	130	11	95	173	114	96
May	45	136	272	230	9	82	79	63	84
June	56	98	263	352	14	48	53	41	85
July	57	95	247	325	14	62	62	50	88
Aug.	66	93	182	237	6	45	84	129	158
Sept.	77	98	131	106	4	80	154	170	180
Oct.	54	94	81	67	3	77	290	200	134
Nov.	71	67	57	18	3	66	436	215	67
Dec.	55	31	26	10	1	62	457	311	47
Mean	67	83	139	128	6	69	243	169	96

MARIINSK.

Daily observed three times, 6 a.m. 2 p.m. and 10 p.m.

220	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1854									
Dec.	0	30	121	32	0	40	220	171	386
1855									
Jan.	118	108	22	0	0	0	247	301	204
Feb.	133	69	84	12	6	25	153	188	330
Mar.	177	27	118	86	27	16	199	123	227
Apr.	218	44	105	184	111	28	105	105	200
May	75	59	108	248	161	75	37	43	194
June	33	105	117	134	167	105	17	22	300
July	134	99	77	139	158	83	53	19	238
Aug.	109	110	5	77	188	131	91	89	200
Oct.	140	91	102	16	80	102	232	75	162
Nov.	105	17	33	6	39	277	284	39	200
Dec.	186	71	29	0	41	233	220	89	131
1856									
Feb.	169	42	0	0	22	29	230	241	267
Mar.	123	37	37	22	102	124	150	124	281
Apr.	161	105	144	245	123	33	67	22	100
May	232	75	151	80	118	70	48	118	108
June	61	72	273	155	189	83	39	50	78

URGA.

4 years, 1870, 1871, 1872 and 1874; daily observed at 7 a.m., 1 p.m. and 9 p.m.

221	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	23	50	145	3	8	3	152	87	529
Feb.	11	58	204	0	7	7	179	50	484
Mar.	45	55	122	8	0	11	177	190	592
Apr.	51	34	85	10	28	21	166	225	380
May	68	27	106	9	23	27	175	280	288
June	100	51	166	27	9	15	94	208	330
July	54	76	153	21	0	31	150	133	382
Aug.	75	80	117	8	9	12	125	207	367
Sept.	69	43	130	26	3	26	121	163	419
Oct.	28	28	121	9	9	17	130	206	452
Nov.	41	58	114	26	9	18	133	160	441
Dec.	40	59	110	13	7	7	82	139	543
Mean	50	52	131	13	9	16	140	171	418

NERCHINSK.

Taken from A. Buchan, "The mean Pressure of the Atmosphere, page 622." 10 years, 1855-64; 10 a.m. and 4 p.m.

222	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	32	0	0	0	0	0	32	129	807
Feb.	36	36	0	0	0	36	71	179	642
Mar.	65	65	32	32	32	65	97	194	418
Apr.	100	67	67	33	67	136	133	267	133
May	65	97	65	65	32	129	129	323	95
June	100	133	100	67	33	67	100	200	200
July	65	97	129	65	32	65	65	161	321
Aug.	32	07	32	65	32	97	97	194	354
Sept.	100	33	33	33	67	100	133	233	268
Oct.	65	32	0	32	32	97	129	258	355
Nov.	33	0	0	0	33	67	133	167	567
Dec.	32	0	0	0	0	32	32	97	807
Mean	60	55	38	33	30	74	96	200	414

BLAGOVESHCHENSK.

2 years, 1860 and 1861; 6 a.m., 2 p.m. and 10 p.m.

223	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	10	0	0	0	0	16	0	135	839
Feb.	36	6	6	18	30	12	12	279	601
Mar.	32	0	5	16	31	0	0	164	752

BLAGOVESHCHENSK—*Continued.*

	N.	N.E.	E.	S.E.	S.	SW.	W.	N.W.	Calm.
Apr.	72	11	38	21	56	32	10	152	607
May	76	5	5	86	60	16	5	44	703
June	73	17	11	28	56	28	39	99	649
July	22	0	21	16	37	5	5	37	857
Aug.	27	5	27	16	43	64	33	92	693
Sept.	50	0	27	22	18	33	16	66	768
Oct.	32	0	0	5	59	5	0	167	732
Nov.	17	6	0	12	18	6	0	95	846
Dec.	10	0	0	0	15	0	0	146	829
Mean	39	4	12	20	35	18	10	123	739

IMPERIAL HARBOUR.

224	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1855									
July	129	48	450	161	83	0	0	0	129
Aug.	113	162	307	48	161	48	0	0	161
Sept.	100	50	316	217	117	50	117	0	33
Oct.	64	194	64	64	340	64	16	194	0
Nov.	251	33	67	0	133	133	150	233	0
Dec.	565	32	64	0	97	32	113	97	0
1856									
Jan.	517	145	129	16	0	64	0	97	32
1858									
Jan.	601	54	0	22	0	11	0	226	36
Feb.	606	36	36	149	30	12	12	36	83
Mar.	505	140	0	172	0	0	0	43	140

OLGA BAY.

225	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1858									
Dec.	90	5	5	5	5	98	473	253	66
1859									
Jan.	111	5	0	0	0	77	444	295	68
Feb.	43	0	60	30	84	126	389	172	96
Mar.	128	16	11	0	109	67	324	150	195
Apr.	73	199	31	31	30	42	235	97	262

PASSJET BAY.

226	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1860									
Dec.	11	11	22	54	22	54	65	686	75

PASSJET BAY—*Continued.*

1861	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan..........	0	100	11	134	0	45	0	699	11
Feb..........	12	36	12	95	24	48	36	737	0
Mar.	22	97	32	172	43	301	75	258	0
Apr..........	22	189	55	367	23	223	0	111	11
May.	0	151	81	473	43	86	32	129	0
June	0	167	144	356	11	222	11	78	11
July..........	0	194	86	398	65	171	11	75	0
Aug.	0	43	43	515	108	194	22	43	32

NEWCHWANG.

2 years, 1862 and 1872.

227	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	129	291	33	66	0	127	33	225	96
Feb.	36	285	0	72	0	249	72	213	73
Mar.	32	260	33	66	33	285	96	162	33
Apr.	33	201	33	66	33	399	33	202	0
May.	33	129	0	33	66	448	33	129	129
June	0	33	0	201	66	535	66	33	66
July	0	33	66	220	96	453	0	66	66
Aug.	66	195	0	192	66	255	33	160	33
Sept.	66	167	0	165	66	234	33	201	66
Oct.	66	191	33	162	66	254	66	96	66
Nov.	165	201	0	201	132	202	0	66	33
Dec.	162	162	66	258	162	91	33	33	33
Mean	66	179	22	142	65	294	42	132	58

PEKING.

21 years, 1841—1873; 7 a.m., 1 p.m., 9. p.m.

228	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan..........	121	70	14	29	49	73	27	275	342
Feb..........	98	72	16	57	95	116	32	225	289
Mar..........	85	75	22	79	140	104	23	206	266
Apr.	79	68	21	81	182	141	25	160	243
May..........	79	62	25	104	214	109	20	177	210
June	108	78	50	129	176	94	10	114	241
July	106	88	37	116	136	71	12	84	350
Aug.	127	102	38	72	126	67	14	92	362
Sept..........	117	76	26	61	137	82	21	164	309
Oct.	99	70	23	46	104	110	44	206	298
Nov.	128	54	13	44	62	81	31	245	342
Dec.	133	58	9	18	49	74	32	276	351
Mean	107	73	24	70	123	94	24	185	300

TAKU.

3 years, 1873-1875 ; 7 a.m., 1 p.m. and 9 p.m.

229	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	73	137	43	78	65	223	126	255	0
Feb.........	60	79	134	148	91	194	119	175	0
Mar.	68	126	132	212	89	158	100	115	0
Apr.........	30	141	189	241	47	136	75	141	0
May	40	111	204	249	78	172	57	89	0
June	37	86	133	311	125	141	64	103	0
July	25	140	169	343	86	129	54	54	0
Aug.........	40	137	126	258	111	172	61	95	0
Sept.	41	97	136	171	119	203	114	119	0
Oct.	25	148	83	111	94	180	180	179	0
Nov.........	55	89	25	78	67	292	108	286	0
Dec....... ..	54	175	89	74	64	229	89	226	0
Mean	46	122	122	189	86	186	96	153	0

CHEFOO.

Daily 10 a.m., 4 p.m. and midnight.

1871 230	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
July	0	75	86	86	398	97	86	86	86
Aug.........	86	183	344	0	269	22	32	22	42
Sept.	122	222	155	22	200	33	11	133	102
Oct.	290	86	65	22	97	161	129	96	54
Nov.........	222	44	33	55	100	166	222	111	47
Dec.........	280	54	0	22	86	118	215	150	75

SHANGHAI.

3 years; two years observations, taken from A. Buchan, "The mean Pressure, etc., page 623," 1867-69, in the morning and evening; and one year taken from the registers of the observatory at Zi-ka-wei, (8 times daily observed.)

231	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.........	303	151	81	35	23	23	23	279	82
Feb.........	201	236	213	95	25	13	25	119	73
Mar.........	203	179	156	168	109	27	37	84	37
Apr.........	187	125	137	175	163	37	63	113	0
May.........	86	111	196	318	159	13	39	39	39
June	100	189	202	152	139	89	38	78	13
July.........	12	73	159	317	268	85	37	37	12
Aug.	124	149	244	208	148	15	36	36	40

SHANGHAI—*Continued.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Sept.	148	247	197	185	49	37	25	99	13
Oct.	146	250	156	84	42	21	21	125	155
Nov..........	258	143	84	61	50	35	128	154	87
Dec..........	271	95	84	51	50	30	62	250	107
Mean	170	162	159	154	102	35	44	118	56

CANTON.

4 years observations, 1785, 1829-1831, taken from "Meyen, On the climate of southern China." Noon and Midnight.

232	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan..........	355	65	80	129	129	16	0	226	0
Feb..........	393	54	80	188	54	9	0	232	0
Mar.	282	57	121	347	81	0	16	96	0
Apr..........	175	33	133	492	33	17	0	117	0
May.........	153	73	113	524	40	8	8	81	0
June	59	25	67	708	100	25	0	16	0
July.........	40	32	57	677	97	57	8	32	0
Aug..........	97	65	07	581	40	8	16	96	0
Sept.........	350	138	108	296	4	4	4	96	0
Oct.	353	105	101	190	57	4	4	186	0
Nov..........	765	17	13	42	63	0	0	100	0
Dec..........	590	93	43	65	89	0	4	116	0
Mean	301	63	84	353	66	12	5	116	0

PETROPAULOVSK.

Observations taken from "Wesselofsky, on the Climate of Russia," page 324.

3 years; 1848-1850.

233	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan..........	231	176	81	114	26	49	101	221	?
Feb..........	226	214	110	110	16	39	68	217	?
Mar..........	113	158	189	144	65	55	144	131	?
April	88	216	138	144	59	36	98	220	?
May.........	49	134	117	238	184	27	152	99	?
June.........	33	158	72	210	191	29	134	172	?
July.........	58	164	66	270	204	22	84	131	?
Aug..........	34	127	82	151	192	17	103	292	?
Sept.........	72	88	120	160	104	16	224	216	?
Oct.	123	134	137	90	36	11	216	252	?
Nov..........	148	198	94	64	0	3	185	309	?
Dec..........	146	377	121	66	11	44	113	121	?
Mean	110	179	110	147	91	29	135	198	?

DUI.

4 years; 1864, 1865, 1866 and 1868;

6 a.m., 2 p.m. and 10 p.m.

234	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	274	129	116	127	73	34	15	126	106
Feb.	314	112	148	170	61	26	30	107	32
Mar.	236	72	115	265	129	50	28	83	22
Apr.	152	50	85	264	236	52	46	74	41
May	160	44	92	236	208	69	55	66	70
June	163	39	81	190	314	59	36	57	61
July	140	40	48	233	275	69	50	37	108
Aug.	125	40	59	311	254	52	28	23	108
Sept.	117	50	83	306	236	32	50	78	48
Oct.	142	73	61	191	270	50	51	111	51
Nov.	174	74	80	159	112	64	69	224	44
Dec.	227	93	94	155	78	24	45	217	67
Mean	185	68	88	218	188	48	42	100	63

KUSSUNAI.

7 a.m., 2 p.m. and 9 p.m.

235	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1860									
Oct.	0	0	268	65	0	108	226	333	0
Nov.	22	0	244	55	0	11	78	590	0
Dec.	0	0	129	194	11	32	91	543	0
1861									
Jan.	237	0	183	257	22	0	0	301	0
Feb.	119	0	119	405	0	0	42	315	0
Mar.	108	0	22	461	22	0	247	129	11
Apr.	0	0	17	406	122	116	195	144	0
May	0	0	22	333	129	183	263	70	0
June	0	12	123	289	0	116	141	215	104
1867									
Aug.	11	34	348	135	56	236	34	11	135
Sept	57	0	553	0	11	80	207	69	23
Oct.	0	0	369	60	60	71	83	119	238
Nov.	55	0	256	78	44	89	223	111	144
Dec.	55	0	208	99	55	44	286	66	187

KUSSUNAI—*Continued.*

1868	N.	N.E.	E.	S.E.	S.	S.W.	W.	NW.	Calm.
Jan..........	60	12	250	131	12	0	202	190	143
Feb..........	50	38	276	187	0	12	125	50	262
Mar..........	34	11	318	216	0	11	262	91	57
Apr..........	0	11	124	291	68	34	202	45	225
May..........	13	26	260	65	130	117	207	65	117
June..........	0	11	237	101	34	157	202	22	236
July..........	29	44	382	103	15	59	103	88	177
Mean for Aug. 1867 July 1868	30	16	299	122	40	76	178	77	162

ANIWA BAY.

7 a.m., noon and 7 p.m.

236	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
1853									
Nov..........	85	149	75	58	47	46	288	195	57
Dec..........	48	86	43	0	22	48	243	166	344
1854									
Jan..........	50	440	88	16	11	133	133	107	22
Feb..........	71	262	48	0	0	0	0	167	452
Mar..........	97	258	0	22	59	70	86	97	311
Apr..........	78	122	55	11	223	55	78	67	311
May..........	32	140	43	32	237	118	97	54	247

HAKODATE.

Observations taken from A. Buchan, "the Mean Pressure, etc., page 623." Hours, 6 a.m., 9 a.m., 3 p.m. and 10 p.m. 3 years, 1840—1842.

237	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	65	0	32	65	0	0	258	548	82
Feb.	71	0	71	71	0	0	321	357	109
Mar.	65	0	129	129	32	32	226	226	161
Apr.	33	0	100	267	67	100	200	133	100
May	32	0	129	355	129	161	129	32	33
June	0	0	100	367	133	133	133	67	67
July	32	0	161	355	97	161	129	32	33
Aug.	32	0	65	387	97	129	161	65	64
Sept.	67	0	67	233	33	33	233	267	67
Oct.	65	0	97	129	45	32	290	322	0
Nov.	67	0	47	67	33	33	333	367	83
Dec.	65	32	32	32	32	32	355	388	32
Mean	49	3	87	205	60	70	231	234	61

NIIGATA.

Taken from "Zeitschrift der Oesterreichischen Gesellschaft fur Meteorologie, T. VIII, page 236. 2 years, 1870 and 1871.

238	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Winter	300	300	33	100	633	600	433	568	33
Spring	228	391	163	228	489	717	522	262	0
Summer ...	391	490	163	228	326	685	457	228	32
Autumn ...	462	560	33	198	429	691	231	363	33

YEDO.

2 years, October 1872—September 1874.

239	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	365	139	22	22	22	22	0	54	354
Feb.	357	119	12	12	48	35	24	36	358
Mar.	354	85	22	22	86	43	0	118	280
Apr.	123	133	78	11	178	189	11	0	227
May	118	97	86	43	280	108	0	11	277
June	67	89	100	122	300	178	11	0	233
July	32	75	54	75	301	140	43	22	258
Aug.	32	32	32	65	344	258	22	32	183
Sept.	244	133	78	44	100	111	22	33	235
Oct.	290	161	54	22	54	54	22	108	235
Nov.	333	155	33	11	55	22	22	33	336
Dec.	376	140	11	11	11	32	22	86	311
Mean.........	225	112	49	38	140	99	17	44	276

YOKOHAMA.

One year, 1865, taken from "Zeitschrift der Oest. Ges. fur Meteorologie, T. VII. page 47.

240	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Winter	2100	120	0	0	210	120	240	60	150
Spring	1020	480	0	0	150	1290	60	0	0
Summer ...	120	480	0	60	90	1380	0	90	780
Autumn ...	420	1050	60	0	30	870	120	120	330

NAGASAKI.

One year, 1872.

241	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Mar.—Aug.	828	691	442	475	351	1682	749	515	267
Sept.—Feb.	1839	1309	458	284	84	284	387	1084	271

DECIMA.

Mean direction of the wind, deduced from 10 years observations, 1845—1855

242

	Intensity.	
January	.768	W. 88° N.
February	.635	W. 81° N.
March	.443	W. 78° N.
April	.155	W. 35° N.
May	.151	W. 57° N.
June	.162	S. 53° W.
July	.610	S. 17° W.
August	.226	S. 31° W.
September	.259	N. 23° E.
October	.600	N. 9° E.
November	.576	W. 86° N.
December	.664	W. 86° N.

KELUNG.

1$\frac{11}{12}$ years; September 1873—July 1875; daily 7 a.m. 1 p.m. and 9 p.m.

243	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	65	656	86	11	0	43	22	22	95
Feb.	107	417	95	24	0	119	24	95	119
Mar.	118	419	43	54	11	108	11	75	161
Apr.	67	333	89	89	44	144	11	11	212
May	32	215	86	75	11	226	22	11	322
June	67	155	44	22	44	344	0	22	302
July	43	172	32	54	65	398	11	22	203
Aug.	32	172	43	54	32	333	22	22	290
Sept.	89	300	55	133	22	155	22	22	202
Oct.	22	667	86	32	11	54	11	0	117
Nov.	11	710	55	33	11	67	11	22	80
Dec.	22	473	97	75	32	97	0	22	182
Mean	56	390	68	55	24	174	14	29	190

VICTORIA.

Taken from A Buchan, "the Mean Pressure of the Atmosphere, etc., page 623." 5 years, 1853-59; 9½ a.m. and 3½ p.m.

244	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W	Calm.
Jan.	97	226	450	65	0	0	65	32	65
Feb.	36	321	357	36	36	36	107	0	71
Mar.	32	258	258	226	32	97	0	65	32
Apr.	0	266	200	333	33	67	33	0	68
May	0	193	225	323	0	97	32	65	65

VICTORIA—*Continued.*

	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
June.........	33	100	168	266	33	233	67	67	33
July	32	65	225	258	65	226	32	65	32
Aug..........	32	129	162	129	32	258	129	32	97
Sept..........	66	133	235	200	33	100	33	100	100
Oct.	65	355	321	65	32	0	65	65	32
Nov.	100	333	234	100	0	33	33	100	67
Dec.	97	290	355	65	0	0	32	65	96
Mean	49	222	266	172	25	96	52	55	63

VICTORIA PEAK.—*Blockhouse.*

Taken from " Zeitschrift der Oesterr. Gess. fur Meteorologie, T. VIII, page 219." 3 yesrs.

245	N.	N.E.	E.	S.E.	S.	S.W.	W.	N.W.	Calm.
Jan.	97	129	677	65	0	0	0	32	?
Feb.	107	179	642	36	36	0	0	0	?
Mar.	32	65	548	194	97	32	0	32	?
Apr.	0	33	333	167	300	133	0	34	?
May	0	0	355	97	323	194	31	0	?
June	0	0	133	200	500	167	0	0	?
July	4	4	69	133	391	328	36	35	?
Aug.	0	0	129	65	290	419	32	65	?
Sept.........	167	100	433	133	100	67	0	0	?
Oct.	129	226	484	65	32	32	0	32	?
Nov.	333	300	367	0	0	0	0	0	?
Dec.	200	264	459	38	0	0	0	39	?
Mean.........	89	108	386	99	173	114	8	23	?

In order to obtain a clear idea of the movements of the air in Eastern Asia, I have contracted the observations of 29 different places, (217)-(245), into the short tables (246) and (247). If any wind considerably surpasses in frequency all other winds, it is inserted as the prevailing wind in the table (246) or (247); if the directions of two prevailing winds are nearly equal (for instance N.W. and W), I have inserted the middle of these two directions (in our case W.N.W). But if two very different directions (for instance N.W. and S. or N. and S.) during any season have nearly the same frequency, I have noted both winds.

In spite of this method of contracting the observations within a short compass, many of the values of our tables (246) and (247) are not exact; partly because the time of observation at many of the places has not been long, partly from faultiness in the method of observing, and, finally, because it has been impossible to eliminate perfectly the daily period.

PREVAILING WINDS AND CALMS.

CONTINENT OF EASTERN ASIA—Table (246).

	Number of years observed.	Winter.	Spring.	Summer.	Autumn.	Year.	Time of Max. of the number of calms.	Time of Min. of the number of calms.	Annual Ampl. of the obsevd. No. of calms.	Annual Mean of the obsvd. No. of cms.
Yakutsk............	15	N.	N.	var.	N.	N.	Feb.	May.	216	469
Ayan	2	S.W. & N.E.	N.E.	N.E. & S.W.	N E.&S.W.	N.E.& S.W.	...	...	195	236
Nikolajevsk	14	W.N W.	E.	E.S.E.	W.N.W.	W.N.W. & E.S.E.	Sept.	Dec.	133	96
Mariinsk	$1\frac{6}{12}$	W.N.W.	S.E.	S.	W.S.W.	...	...	...	...	...
Urga	4	E. & W.	W.N.W.	N.W.	W.N.W. & E.	W.N.W.	Dec.	May	255	418
Nerchinsk.........	10	N.W.	N.W.	var.	W.N.W.	W.N.W.	Jan.	May	712	414
Blagoveshchensk	2	N.W	N.W.	var.	N.W.	calm	Nov.	May	193	739
Imp. Harbour ...	...	N.	...	E.	...	...	...	...	...	...
Olga	...	W.N.W.	...	...	...	...	...	...	...	...
Posjet...............	...	N.W.	S.E.	S.E.	...	...	...	...	...	...
Newchwang......	2	var.	S.W.	S.W. & S.E.	S.S.W.	S.W.	...	...	...	58
Peking	21	N.N.W.	S. & N.W.	S.S.E. & N.	N.N.W.	N.N.W. & S.	Dec., Aug.	May, Oct.	152	300
Taku	3	var.	E.S.E.	E.S.E.	W.	...	...	...	...	...
Shanghai	3	N.	E.	S.E.	N.N.E.	N.E	Oct.	April	155	56
Canton	4	N.	S.E.	S.E.	N.	S.E. & N.	...	...	...	...
Bangkok	...	N.E.	...	S.W.	...	...	...	...	...	...

ISLANDS OF EASTERN ASIA—Table (247).

	Number of years observed.	Winter.	Spring.	Summer.	Autumn.	Year.	Time of Max. of the number of calms.	Time of Min. of the number of calms.	Annual Ampl. of the obsevd. No. of calms.	Annual Mean of the obsvd. No. of cms.
Petropaulovsk ...	3	N.N.E.	var.	var.	N.W.	N.W. & N.E.	...	...	...	...
Dni	4	N.	S.S.E.	S S E.	S.S.E. & N.N.W.	S.S.E. & N.N.W	Jan.-Aug.	Mar.-Nov.	86	63
Kussunai	1	E.S.E. & W.	E. & W.	E.	E.	E.	...	...	...	162
Aniwa................	...	N.E.	N E & S.	...	...	...	...	...	...	...
Hakodate	3	W.N W.	var.	S.E.	W.N.W.	W.N.W & S.E.	Mar.-Apr.	Jan.-Nov.	161	61
Niigata	2	var.	S.W.	S.W.	S.W	S.W.	...	...	...	...
Yedo	2	N.	N. & S.	S.S.W.	N.	N. & S.	Jan.	Aug.	174	276
Yokohama.........	1	N.	S.W. & N.	S.W.	S W & N.E.	...	...	...	...	...
Decima	10	N.	N.N W.	S.W.	N.	...	...	...	...	...
Kelung	2	N E.	N.E & S.W.	S.W & N.E.	N E.	N.E. & S.W.	May	Nov.	242	190
Victoria............	5	E.N E.	E.	E.S.E. & S.W.	E.N.E.	E.	...	...	68	63
Victoria Peak ...	3	E.N.E.	E. & S.	S. & S.W.	E.N E.	E.	...	...	...	...
St. Anna, near Manila		N.E.	E.N E.	S.W.	S.S.W.	...	...	...	...	...

According to these tables (246) and (247) I have drawn the annexed five charts.

The calms are most frequent at Yakutsk, Urga, Nerchinsk and Blagoveshchensk; where the annual average is 510, or more than the half of all observed conditions of the atmosphere, the number of which is accepted as equal to 1,000 [cf. column "Mean" of preceding tables]. At the four places mentioned the calms are most frequent during the winter; namely, 692 or almost 70 per cent. of all observations.

It is probable, that on the whole East Asiatic continent the winter is the calmest (the calms reach their maximum of frequency) and the spring the least calm season (the calms have their minimum of frequency).

In China, moreover, these seems to occur a second maximum of frequency of calms in summer; and a second minimum in autumn.

With regard to the annual period of the calms on the islands of Eastern Asia, we cannot define it, partly from defectiveness of the observations, and partly because the calms there play no important part. Also on the coast of the continent, at Ayan, Nikolajevsk, Newchwang, Peking and Shanghai, the annual mean of the calms is small. The annual mean of the calms is namely: (1) In the interior of the Amoor-Territory, at Yakutsk, Urga, Nerchinsk and Blagoveschensk, 510, or 51 per cent. of all conditions of the atmosphere, observed during the year. (2) On the coast of the continent, at Ayan, Nikolajevsk, Newchwang, Peking and Shanghai, 149, or 15 per cent. of all atmospheric conditions, observed during the year. (3) On the islands of Eastern Asia, 136, or 14 per cent. of all atmospheric conditions, observed during the year.

Our wind charts, confirm the above opinion in regard to the distribution of the atmospheric pressure in Eastern Asia at the different seasons. During the *winter* the air, most cooled and partly coming from above, leaves the central region of the great continental Asiatic anticyclone, characterized by great frequency of calms or feeble winds, and moves horizontally to E., S.E. and S. In the beginning the movement is slow; later on, farther from the central region more quick, so that near the coast of the continent (Peking, Nikolajevsk, Vladivostok) vehement winds sometimes appear, distinguished by bringing sharp cold.

The movements of the air in the Amoor-Territory, and Northern China are directed from W.N.W. to E.S.E., or from N.W. to S.E., or from N.N.W. to S.S.E. and curve continually

in accordance with the daily course of the sun: so we (cf. chart) encounter on the seas of Japan and China, the N., N.N.E. and N.E. winds.

In *spring* (cf. chart) two air currents rule in Eastern Asia, one contrary to the other; one comes from the Pacific and touches in an approximately eastern direction the southern coast of Nipon, and in a E.S.E. direction the mouth of the river Amoor. The other air current is continental, its direction is from N.W. to S.E., and within it lies the whole Amoor-Territory, except the mouth of the river Amoor, Corea and the most northern part of China.

The S.E. wind rules during the winter over the southern sea of China, and turns, from winter to spring, continuously toward the E.; because, as I have remarked above, the central region of a cyclone is formed in April over India (within the Ganges), whither streams the air from all sides—therefore, from the sea of Southern China in an eastern direction, India and Southern China being situated nearly on the same latitudes.

From spring to *summer*, the central region of the above-mentioned cyclone, where the air is attenuated and hot, proceeds and extends to N., and in the middle of July passes the 40th degree of latitude; then, in the sea of Southern and Middle China the wind, which has turned from winter to spring from N.E. to E., continues changing in the same direction, and becomes S. and S.W., according to the chart.

In the summer the continental N.W. wind in the Amoor-Territory, in Corea and most the northern part of China dominates no longer, but its place is supplied by oceanic air currents S.W., S., S.S.E. and S.E., similar to those prevailing also in the whole of China over the other winds.

In *autumn* (cf. chart) the continental air currents, which have prevailed in winter, have again the superiority in regard to the other wind directions.

Whether the prevailing wind of any place is normal or abnormal, i.e. if local influences—for instance quality of the soil, distribution of land and water in the near vicinity or temporary disturbances (for the small duration of the time of observation) have affected it, we can decide by means of the charts, because in winter and summer the winds, represented by our charts, prevail over all other winds more than in spring and autumn. The anomaly will, therefore, be represented by the deviation of the small arrows from the long arrows; the former indicating the observed direction at each place, and the latter the normal air currents *en gros*.

From this, we learn, that the wind has an abnormal direction in winter at Ayan, Imperial Harbour, Olga, Newchwang, Taku, Dui, Kussunai, Aniwa, Hakodate, Niigata, and in summer at Ayan, Mariinsk, Imperial Harbour, Dui, Kussunai, and Niigata.

But as observations have been made at these places for but a short time, it is impossible to decide if these anomalies are produced by local constantly acting influences, or by disturbances, varying from year to year.

In order to give a more complete explanation of the movement of the air in Eastern Asia, there remain to add some data on the sharp whirlwinds, the so-called *typhoons*, occurring in the China sea and Southern Japan. It is well-known, that their extraordinary destructive force is due to the great mass of aqueous vapour contained in them.

They appear only upon the ocean, near the Tropics, and are most frequent in the hottest season, when the ocean on its surface has reached its annual maximum of temperature; consequently near Western India, in the northern Indian ocean, and in the sea of China, in September, the end of the summer. For, the evaporation induced by the high temperature being very great, the calm air, covering the ocean, becomes saturated with aqueous vapour, which is specifically lighter than the dry air, resting in higher regions of the atmosphere; and produces a state of unstable equilibrium, which disturbed by some, even insignificant cause, such as a light breeze coming from a distance, causes a violent ascending air current.

The latter forms the central region of a barometric minimum, whither the air from all sides flows, especially the light aqueous vapour, if it exists in the vicinity.

Such a cyclone extends in that direction, where it finds aqueous vapour; and the central regions of cyclones rise and disappear continuously together, seeming to march over the surface of the globe.

The typhoons follow the warm currents of the ocean, and disappear when the access of warm aqueous vapour is cut off; and also, when they reach the land or high latitudes.

The typhoons of the East Asiatic seas begin mostly near latitude 10° upon the ocean; proceed at first from E. to W., afterwards to W.N.W., W. or W.S.W. and disappear on the continent.

Only a few of them turn, near Formosa, to N. and N.E. and follow the Kuro-siwo along the southern shores of Nipon.

In this respect the Chinese typhoons differ, for instance, from

the West Indian hurricanes, whose centre ordinarily runs through a parabola, the vertex of which lies between the 20th and 30th degree of latitude, and whose convex side is turned to the West.

Further, the Chinese typhoons have ordinarily smaller diameters and move more slowly than the West Indian hurricanes. They seem often without movement.

The typhoon is visible at a great distance by dark rainy clouds over its centre, formed by the aqueous vapour condensed in high regions, whither it has been brought by the ascending motion within the centre of the cyclone.

On the chart the most frequent directions of the typhoons are indicated by long, interrupted red arrows. The frequency of tropical storms is indicated by the following table :—

248	Jan.	Feb.	Mar.	Apr.	May.	June.	July.
Western India and the northern part of the Atlantic, 1493-1855 ..	5	7	11	6	5	10	42
Northern part of the Indian Ocean...	1	2	4	9	14	6	3
China sea, 1780-1845		...	...	...	...	2	5
Southern part of the Indian Ocean 1809-1848	9	13	10	8	4	...	...
Mauritius, 1820-1844	9	15	15	8	...	...	...

	Aug.	Sept.	Oct.	Nov.	Dec.	Sum.	Number of years observed
Western India and the northern part of the Atlantic, 1493-1855.	96	80	69	17	7	355	362
Northern part of the Indian Ocean...	5	11	17	11	5	88	...
China sea, 1780-1845	5	18	10	6	...	46	65
Southern part of the Indian Ocean 1809-1848		1	1	4	3	53	39
Mauritius, 1820-1844		...	...	...	6	53	24

According to table (248) on the China sea typhoons occur comparatively seldom, namely, during the year less than once; while in Western India exactly one hurricane, in the southern Indian Ocean more than one storm, and near Mauritius more than two storms occur during the year.

IV.—HYDROMETEORS.

1.—Cloudiness. *a.*—Daily Period.

For an exact determination of the daily period of the cloudiness, it is necessary to have many hourly observations ranging through a great number of years. Such observations have been made at only a few places in Eastern Asia, and are inserted by me in the following tables (249), (250) and (251).

DAILY PERIOD OF THE CLOUDINESS.

NIKOLAJEVSK.

13 years; 1857-1871.

249 Per cent.

	6 a.m.	2 p.m.	10 p.m.	Mean.
January	40.4	36.7	34.5	37.2
February..............	37.3	40.7	31.8	36.6
March	43.8	45.1	37.8	42.2
April	55.4	57.7	52.8	55.3
May....................	64.6	59.2	55.5	59.8
June	62.3	57.2	56.6	58.7
July....................	59.5	56.2	56.8	57.5
August	66.3	60.5	57.8	61.5
September	59.5	56.6	49.0	55.0
October	59.0	62.0	55.1	58.7
November	59.6	59.2	53.9	57.6
December	49.7	49.2	44.3	47.7
Mean	54.8	53.4	48.8	52.3

PEKING.

22 years; 1841-1874.

250 Per cent.

	7 a.m.	1 p.m.	9 p.m.	Mean.
January	23.5	19.7	15.8	19.7
February......	30.3	22.5	19.5	24.1
March	37.5	30.7	29.8	32.7
April	42.7	37.7	37.1	39.2
May....................	39.4	41.1	40.5	40.3
June	45.7	45.3	45.4	45.5
July....................	57.0	52.8	53.1	54.3
August..................	50.0	45.1	44.8	46.6
September	41.3	38.6	34.4	38.1
October	28.9	23.1	21.0	24.3
November	24.5	22.7	21.1	22.8
December	21.5	18.9	14.7	18.4
Mean	36.8	33.2	31.4	33.8

ANNUAL MEANS.

Per cent.

251	About 6 a.m.	2 p.m.	10 p.m.	No. of years observed.
(1) Yakutsk	46.0	44.2	41.8	25
(2) Nerchinsk	32.8	37.5	27.2	26
(3) Nikolajevsk.........	54.8	53.4	48.8	13
(4) Irkutsk	39.8	33.5	33.0	14
(5) Peking..............	36.8	33.2	31.4	22
Mean of (1), (3), (4) and (5)	44.4	41.1	38.7	...

The numbers in table (251) for Yakutsk, Nerchinsk and Irkutsk I have taken from "Repertorium fur Meteorologie, herausgegeben von der K. Akademie der Wissenschaften zu St. Petersburg, Tome V. p. 270" but the other numbers of (251) and tables (249) and (250) are calculated by myself. The cloudiness, therefore, in its annual average decreases from morning (near 6 o'clock) till noon and evening (near 10 o'clock at all our stations; except Nerchinsk, where it is smaller in the evening, but at noon greater than in the morning.

At the time of the daily minimum of the temperature, near sunrise, the relative humidity has reached its daily maximum; vertical air currents, produced by the daily period, not existing, the cloudiness therefore is great.

At the time of the daily minimum of the temperature, in the first hours of the afternoon, the relative humidity has its daily minimum, consequently also the cloudiness should reach its minimum. That this is not the case, and that the cloudiness, on the contrary, decreases not only from sunrise to noon about 3·3 per cent, but also decreases from noon to 10 o'clock in the evening 2·4 per cent, must be explained by the ascending air current, which rises owing to the daily insolation, and brings warm and humid air from the globe's surface to higher and cooler regions, where its aqueous vapour becomes condensed and forms clouds. This daily ascending air current is most intense in the first hours of the afternoon, and increasing the cloudiness hinders the formation of its daily minimum near noon.

Only near midnight, when the ascending air current has come to an end and a descending air current begins, appears the minimum of cloudiness; because then the relative humidity is still considerably smaller than at sunrise. For example at

Peking, we have on an average of the year the relative humidity and cloudiness, at

7 a.m.	1 p.m.	9 p.m.
68	49	63
37	33	31

These two series of numbers obtain a similar daily range, if we suppose, that, in higher regions of the atmosphere by the influence of the (daily) ascending air current the relative humidity 49 per cent, at 1 p.m., becomes greater viz. equal to about the mean of the relative humidity 68 per cent, at 7 a.m. and of the relative humidity 63 per cent, at 9 p.m.

b.—ANNUAL PERIOD.

The monthly means of cloudiness, tables (252) and (253) I have contracted in 6 groups I, II, III, IV, V and VI for a better survey of the laws expressed by the observed quantities.

In reference to the cloudiness, Yakutsk agrees with the stations of more western Siberia: it has in spring its annual minimum, and in autumn its annual maximum.

All points, situated in the Amoor-Territory and Northern China, group I, II and III, are subjected to a sharply defined period, with one annual minimum in winter, and one annual maximum in summer.

The annual amplitudes are:

For group	I.	25	per cent.
" "	II.	34	" "
" "	III.	31	" "

What is the nature of the annual period of cloudiness in Southern China, we cannot determine by means of the observations made there till the present time.

Probably it will be found not to deviate much from that of Northern China. On the east Asiatic islands the monthly march of cloudiness differs much from that of the opposite continent, as is proved by the three groups IV, V and VI.

The annual amplitude is only a small quantity.

The annual amplitude of Saghalin, group IV, resembles much that of Okhotsk, Ayan, Nikolajevsk and Mariinsk or group I.

But the annual amplitude is on the continent, group I, 25 per cent, on Saghalin only 10 per cent.

Also in Japan, Formosa and the Philippine Islands—groups V. and VI.—the annual amplitude of the cloudiness is very small, and it is impossible, to determine exactly the times of maximum and minimum, from the defectiveness of the observations.

The great annual amplitude of the cloudiness on the continent—groups I., II. and III.—and the much smaller on the islands we explain as follows :

During the winter there blow cold N., N.W. and W. winds, arriving from the dry interior of the continent, and from above, towards the coasts and islands of Eastern Asia. The dry air of the inner Asiatic anti-cyclone thus passes from cold and high countries into warmer and lower regions, the relative humidity becomes very small, consequently also the cloudiness is extraordinarily small and reaches on the continent then its annual minimum. But as these N., N.W. and W. winds touch the sea, they lose successively their original character of dryness and coldness, becoming wet, and so may produce a winter minimum of cloudiness at Saghalin, but not in Southern Japan, group V.

During the summer, the contrary phenomenon occurs. Then, S.W., S., S.E. and E. winds bring warm and humid air from the Pacific ocean to the islands and coast of the East Asiatic continent, where the air must ascend to high regions, partly in consequence of the elevation of the land above the sea, partly in consequence of the ascending current of the summer cyclones. The relative humidity and the cloudiness of the air of the islands will be little increased, being considerable in all seasons, on account of the neighbourhood of the surrounding water, but that of the continent becomes considerable.

Also on the East Asiatic continent in winter three circumstances unite—the dryness of the continental air, its descending movement from above to below within the central region of the great Asiatic winter anti-cyclone, and its movement from cold, more northern, or more north-western, or more elevated into warmer, more southern, or more south-eastern or lower countries—to produce a very low minimum of the cloudiness in winter: and in summer three other correspondent causes—the great moisture of the air of the Pacific, the movement from warm countries to cooler, and the ascent in consequence of the elevation of the land and of the great summer cyclone

of Asia—to produce a high annual maximum of cloudiness.

The groups I., II. and III. prove evidently, that the annual period of the cloudiness depends not only upon the annual period of the relative humidity, but also upon the quality and intensity of the vertical air currents.

For, according to I., II., III. and table (266), only the time of the annual maximum of the cloudiness coincides with that of the maximum of the relative humidity; the time of the annual minimum of the cloudiness, on the contrary, occurs in winter, but the time of the minimum of the relative humidity in the spring.

An ascending air current increases the cloudiness and a descending air current diminishes it. Therefore, though the relative humidity decreases from winter to spring, the cloudiness increases at the same time; because in consequence of the sun's course to the North over Southern and Middle Asia, it developes an ascending air current. This is further increased by the large extent of cloudiness more than the decrease of the relative humidity observed in low regions of the atmosphere diminishes it.

At Yakutsk the time of the annual minimum of the cloudiness coincides with that of the relative humidity occurring in spring, because in March in the high latitude of Yakutsk, the ascending air current has not yet commenced.

In Europe the monthly advance of the cloudiness is contrary to that on the continent of Eastern Asia: the cloudiness has its annual maximum in winter and annual minimum in summer. Consequently while in Europe the amount of cloudiness elevates the temperature as well in winter as in summer; in the Amoor-Territory and Northern China, the amount of cloudiness diminishes the temperature of the air during both these seasons.

The absolute value of the cloudiness is, according to the prevailing continental winds and small moisture of the air on an average of the year in Eastern Asia small, smaller than *e.g.* in Europe.

In the interior of the continent of Eastern Asia—groups II and III—the annual mean of cloudiness is equal to 32 per cent: on the coasts of the sea of Okhotsk, on Saghalin, and in Japan —groups I, IV and V—a half greater, namely 49 per cent: and on the southern islands of Eastern Asia still greater, namely 61 per cent.

MONTHLY MEANS OF THE CLOUDINESS.

Continent of Eastern Asia.—Table (252).

Per cent.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed.	
Yakutsk	46	35	26	37	49	49	47	49	55	69	48	46	46	25	1829-1853, Repertorium II, p. 257*
Okhotsk	28	29	36	39	49	46	53	51	42	37	32	30	39	7	1814-1850, ,, II, p. 259
Ayan	21	21	30	34	49	49	49	49	47	32	29	17	35	4	1845, 48-1850, ,, II, p. 256
Nicolajevsk ..	37	37	42	56	61	58	59	63	54	59	56	48	52.5	14	1857-1872, Schrenck; Amur Reise T.IV.
Mariinsk......	76	35	36	61	43	48	51	42	50	57	28	46	48	1	,, ,,
Urga	16	13	25	32	36	47	49	44	28	25	27	24	30	4	1870, 1871, 1872, 1874.
Nerchinsk	13	14	22	36	44	47	48	46	40	38	25	19	33	26	1839-1864, Repertorium II.
Blagoveshchensk	12	23	15	25	19	39	28	41	27	27	29	25	26	2	1860-1861.
Vladivostok ..	..	26	57	84	64	75	68	62	53	55	43	37	..	11/12	1873, Annalen of the Physical Observa-
Si-wan-tse	21	27	32	31	42	43	57	43	38	39	22	31	35	2	Sept. 1873—Aug. 1875. [tory at Peters-
Kalgan	17	14	..	..	..	..	..	38	53	19	17	25	..	7/12	Aug. 1871—Feb. 1872. [burg, 1874.
Newchwang ..	27	21	46	42	36	37	33	34	28	22	31	39	33	1	1872.
Peking	20	24	33	39	40	45	54	47	38	24	23	18	34	22	1841-1874.
Tientsin	11	20	24	37	8	14	23	43	44	35	27	43	27	1	1872.
Taku	22	22	23	25	31	32	44	29	30	27	12	17	26	3	1873-1775.
Chefoo	41	..	..	..	..	..	46	42	34	18	37	61	..	7/12	July 1871—Jan. 1872.
Shanghai	72	77	67	58	64	85	54	51	63	60	41	35	61	1	1875-1876.
Fu-cheu-foo ..	..	..	..	57	74	38	48	22	47	45	66	37	..	9/12	1870.

* Repertorium für Meteorologie, herausgegeben von der Kaiserlichers Academie der Wissenschaften zu St. Petersburg.

Islands of Eastern Asia.—Table (253).

Per cent.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed.	
Petropaulovsk..	34	36	50	40	40	39	41	44	39	41	42	48	41	4	1846-1850, Repertorium II, p. 259.
Dui	54	49	51	51	57	53	51	58	51	58	68	55	55	4	Schrenck, Amur-Reise IV.
Kussunai......	59	55	51	44	55	71	67	58	53	53	69	67	58.5	2	" " "
Aniwa Bay	40	31	50	65	47	46	56	68	48	30	51	50	48	1	" " "
Yokohama	50	55	60	64	63	62	61	60	59	58	55	52	58	1	1865; O. Z. VII. p. 47*.
Osaka	49	64	58	67	63	78	68	58	73	55	67	47	62	1	1870.
Nagasaki......	42	40	37	55	25	47	47	32	49	24	28	28	38	1	1872.
Decima	57	55	52	53	48	57	50	43	43	48	49	58	51	10	1845-1855.
Kelung........	88	81	71	66	71	42	40	44	58	71	69	60	63	1½	Sept. 1873—July 1875.
Manila........	50	54	47	42	55	72	76	68	75	67	52	59	60	4	O. Z. VIII. p. 334.

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		Jan.	Feb.	Mar.	Apr.	May.	June.	Ju'y.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed.
Okhotsk, Ayan, Nikolajevsk, Marinsk	I	34	32	38	48	55	53	56	57	50	49	44	38	46	26
Urga, Nerchinsk, Blagoveshchensk	II	13	14	22	35	41	46	47	45	38	36	26	20	32	32
Si-wan-tse, Newchwang, Peking, Tientsin, Taku..	III	20	24	32	37	38	42	51	44	37	26	22	20	33	29

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		Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed.
Dui, Kussunai, Aniwa, Petropaulovsk	IV	46	44	51	47	50	51	51	54	47	48	57	54	50	11
Yokohama, Osaka, Nagasaki, Decima	V	55	55	52	55	49	58	52	45	47	47	49	54	51	13
Kelung, Manila	VI	63	63	55	50	60	62	64	60	69	68	58	59	61	6

* Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie, herausgegeben von Dr. Telinek und Hann, Wien.

2.—THE PRESSURE OF AQUEOUS VAPOUR AND RELATIVE HUMIDITY.

a.—Daily Period.

For hourly observations on the pressure of aqueous vapour and relative humidity in Eastern Asia, we have only for two stations, Nerchinsk and Peking. The results of these observations are the following:—

NERCHINSK.

Hourly Range of the Pressure of Aqueous Vapour.—Millimetres.—Table (256).

Mean of observations, made during 1844, 1848 and 1851-1862.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Midnight	0.30	0.47	1.20	2.56	4.13	7.74	10.30	8.90	5.52	2.63	1.04	0.44	3.77
1	0.30	0.46	1.16	2.55	4.09	7.63	10.18	8.74	5.46	2.64	1.02	0.43	3.72
2	0.29	0.45	1.12	2.50	4.04	7.54	10.02	8.59	5.35	2.61	1.00	0.42	3.66
3	0.29	0.43	1.08	2.45	4.00	7.42	9.87	8.45	5.25	2.57	0.97	0.41	3.60
4	0.28	0.42	1.04	2.40	3.99	7.38	9.78	8.34	5.15	2.53	0.96	0.41	3.56
5	0.28	0.41	1.00	2.39	4.10	7.64	10.01	8.35	5.09	2.48	0.93	0.41	3.59
6	0.27	0.41	0.99	2.52	4.30	8.20	10.60	8.67	5.11	2.44	0.93	0.40	3.74
7	0.27	0.40	1.09	2.73	4.54	8.66	11.28	9.29	5.43	2.50	0.93	0.39	3.96
8	0.28	0.45	1.30	2.90	4.68	9.08	11.84	9.94	5.91	2.71	0.96	0.40	4.20
9	0.31	0.54	1.51	3.12	4.78	9.32	12.29	10.44	6.21	2.93	1.10	0.44	4.41
10	0.39	0.67	1.65	3.16	4.85	9.38	12.55	10.77	6.52	3.11	1.26	0.54	4.57
11	0.45	0.76	1.84	3.30	4.84	9.31	12.63	10.88	6.69	3.21	1.41	0.62	4.66
Noon	0.50	0.84	1.05	3.38	4.78	9.16	12.62	10.91	6.82	3.37	1.56	0.68	4.71
1	0.54	0.90	2.05	3.37	4.73	9.12	12.52	10.90	6.80	3.44	1.60	0.72	4.72
2	0.53	0.93	2.12	3.37	4.71	9.10	12.44	10.84	6.80	3.45	1.62	0.71	4.72
3	0.50	0.90	2.12	3.32	4.70	9.04	12.33	10.72	6.68	3.41	1.56	0.65	4.66

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
4	0.44	0.84	2.07	3.27	4.62	9.01	12.19	10.61	6.60	3.32	1.43	0.56	4.58
5	0.38	0.72	1.92	3.21	4.60	8.90	12.07	10.53	6.53	3.21	1.30	0.51	4.49
6	0.35	0.62	1.72	3.14	4.57	8.86	12.09	10.60	6.48	3.06	1.21	0.48	4.43
7	0.33	0.55	1.51	3.04	4.64	8.92	12.15	10.48	6.30	2.94	1.17	0.46	4.37
8	0.32	0.52	1.40	2.85	4.54	8.77	11.83	10.01	6.08	2.86	1.13	0.45	4.23
9	0.31	0.51	1.33	2.77	4.38	8.42	11.26	9.59	5.92	2.80	1.11	0.45	4.07
10	0.31	0.50	1.28	2.68	4.27	8.08	10.84	9.31	5.73	2.76	1.09	0.45	3.94
11	0.30	0.49	1.24	2.64	4.20	7.90	10.54	9.13	5.62	2.73	1.06	0.44	3.86
Mean	0.36	0.59	1.49	2.90	4.46	8.52	11.43	9.79	6.00	2.91	1.18	0.49	4.18

NERCHINSK.

HOURLY RANGE OF THE RELATIVE HUMIDITY.—PER CENT—Table (257).

Mean of the years: 1844, 1848 and 1851–1862.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Midnight	71.0	68.6	71.1	69.2	65.6	75.4	84.2	84.5	79.6	73.1	69.2	70.8	73.5
1	71.1	68.7	71.2	70.5	67.5	76.9	85.8	85.5	81.3	74.2	69.8	70.8	74.4
2	71.4	68.5	71.4	71.6	69.1	79.1	87.2	87.0	82.8	75.3	70.1	70.3	75.3
3	72.0	68.1	71.0	72.4	70.8	80.7	87.9	88.0	83.7	76.0	79.6	71.4	76.0
4	72.1	68.3	71.2	72.9	71.9	82.1	89.1	88.8	84.6	76.6	69.3	72.2	76.6
5	72.7	69.3	70.9	73.6	73.1	82.4	89.3	89.5	85.4	77.0	69.1	72.3	77.1
6	72.6	69.8	71.3	73.9	70.9	80.6	88.4	89.4	85.6	77.1	69.5	71.9	76.7
7	73.3	70.4	73.9	72.7	66.9	77.1	85.7	87.7	84.5	78.4	70.1	72.4	76.1
8	73.5	72.6	78.1	69.0	61.4	71.6	80.9	83.8	80.6	77.5	71.4	73.1	74.5
9	74.5	77.0	79.5	65.0	56.2	65.4	75.5	78.4	74.4	73.6	74.6	75.3	72.4
10	77.4	79.6	78.9	61.9	52.1	60.1	70.9	73.3	69.1	69.4	76.5	77.4	70.6

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
11	78.7	80.7	77.7	59.8	49.3	56.1	67.3	68.8	63.8	65.7	76.9	79.1	68.7
Noon	79.7	80.0	77.0	58.4	46.4	53.1	63.9	65.1	60.3	62.4	76.9	80.7	67.1
1	78.9	81.1	75.6	56.4	45.3	51.4	61.8	62.1	57.4	60.4	75.2	79.8	65.4
2	77.1	80.1	74.2	55.1	44.3	50.1	60.6	60.4	56.0	59.1	73.9	78.1	64.1
3	73.9	78.6	73.7	54.4	43.8	49.7	59.5	60.2	54.8	58.4	72.6	74.9	62.9
4	70.6	74.3	73.1	54.3	43.6	49.9	60.0	60.9	55.1	59.6	71.4	71.4	62.0
5	70.1	70.1	72.6	54.6	44.1	51.5	61.7	62.6	57.6	62.6	71.1	70.1	62.4
6	69.5	68.4	72.2	57.6	47.1	54.3	65.0	66.9	63.6	65.4	70.4	69.6	64.2
7	69.1	67.6	71.3	62.1	52.3	58.4	70.4	73.1	69.7	67.1	69.5	69.7	66.7
8	68.1	67.4	70.5	64.2	56.9	64.3	75.6	77.4	73.0	68.2	69.0	69.5	68.7
9	68.9	67.2	70.9	66.1	60.2	68.5	78.9	79.9	75.3	69.6	68.8	69.8	70.3
10	69.6	68.1	70.7	67.2	62.6	70.6	81.3	81.6	77.1	71.0	68.9	70.1	71.6
11	70.6	68.1	70.9	68.5	64.5	73.1	82.9	83.3	78.4	72.4	69.1	70.7	72.7
Mean	72.8	72.2	73.3	64.6	57.7	65.9	75.6	76.6	72.2	69.6	71.4	73.0	70.4

PEKING.

Hourly Range of the Pressure of Aqueous Vapour.—Millimetres.—Table (258).

Mean of observations, made 1850—1855.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Midnight	2.13	2.24	3.65	5.35	8.69	12.78	18.92	16.88	11.82	6.58	3.69	2.42	7.93
1	2.11	2.16	3.61	5.30	8.60	12.69	18.80	16.71	11.67	6.50	3.66	2.39	7.85
2	2.09	2.14	3.55	5.22	8.56	12.64	18.57	16.54	11.52	6.36	3.61	2.36	7.76
3	2.06	2.11	3.50	5.17	8.51	12.50	18.34	16.34	11.32	6.25	3.57	2.30	7.66
4	2.04	2.08	3.43	5.13	8.43	12.40	18.13	16.16	11.13	6.13	3.53	2.27	7.57
5	2.01	2.06	3.40	5.15	8.42	12.37	18.08	15.85	10.97	5.92	3.47	2.25	7.50

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
6	1.97	2.02	3.34	5.17	8.61	12.64	18.31	15.87	10.84	5.88	3.44	2.22	7.53
7	1.95	2.01	3.39	5.28	8.82	12.90	18.59	16.18	11.04	5.90	3.42	2.21	7.64
8	1.99	2.12	3.47	5.43	8.92	13.12	18.93	16.47	11.32	6.16	3.51	2.25	7.81
9	2.11	2.26	3.58	5.55	9.00	13.27	19.19	16.71	11.41	6.31	3.62	2.37	7.95
10	2.26	2.40	3.68	5.66	9.08	13.31	19.48	16.80	11.59	6.48	3.69	2.45	8.08
11	2.38	2.49	3.76	5.70	9.19	13.44	19.67	16.93	11.67	6.63	3.71	2.59	8.18
Noon	2.47	2.46	3.87	5.76	9.32	13.56	19.64	16.97	11.68	6.79	3.73	2.68	8.25
1	2.49	2.54	3.92	5.79	9.25	13.52	19.63	17.04	11.70	6.83	3.80	2.71	8.27
2	2.51	2.59	3.91	5.77	9 24	13.45	19.55	17.09	11.81	6.85	3.78	2.71	8.27
3	2.49	2.64	3.89	5.68	9.27	13.35	19.44	17.10	11.76	6.85	3.77	2.77	8.25
4	2.47	2.60	3.88	5.66	9.12	13.33	19.40	17.22	11.78	6.80	3.82	2.77	8.24
5	2.47	2.60	3.90	5.67	9.09	13.38	19.54	17.25	12.03	6.95	3.90	2.74	8.29
6	2.40	2.52	3.88	5.62	9.13	13.41	19.57	17.32	12.26	7.03	3.92	2.73	8.32
7	2.33	2.47	3.85	5.65	9.14	13.44	19.62	17.42	12.43	7.06	4.03	2.70	8.34
8	2.29	2.43	3.81	5.67	9.09	13.31	19.66	17.39	12.35	7.02	3.98	2.64	8.30
9	2.25	2.37	3.80	5.62	8.99	13.23	19.51	17.30	12.24	6.88	3.91	2.57	8.22
10	2.19	2.33	3.76	5.55	8.90	13.11	19.30	17.15	12.13	6.78	3.84	2.52	8.13
11	2.17	2.29	3.76	5.46	8.83	12.92	19.13	17.11	11.98	6.65	3.76	2.49	8.05
Mean	2.23	2.33	3.69	5.50	8.93	13.09	19.13	16.83	11.69	6.57	3.71	2.50	8.02

PEKING.

HOURLY RANGE OF THE PRESSURE OF AQUEOUS VAPOUR.—MILLIMETRES.—Table (259).
Mean of the years, 1841—1855.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
5 a.m.	1.78	2.19	3.21	5.19	7.97	12.35	17.15	15.87	10.75	5.81	3.28	2.10	7.30
7 a.m.	1.73	2.14	3.21	5.40	8.39	12.91	17.73	16.35	10.93	5.85	3.24	2.05	7.49

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
9 a.m.	1.89	2.39	3.46	5.64	8.55	13.06	18.26	16.76	11.40	6.19	3.48	2.19	7.77
11 a.m.	2.16	2.62	3.59	5.78	8.62	13.15	18.55	16.96	11.50	6.36	3.58	2.39	7.94
1 p.m.	2.27	2.64	3.67	6.75	8.63	13.09	18.62	16.97	11.45	6.46	3.65	2.49	7.97
3 p.m.	2.27	2.69	3.61	5.37	8.51	12.89	18.52	16.93	11.42	6.51	3.62	2.51	7.92
5 p.m.	2.22	2.64	3.58	5.46	8.32	12.89	18.49	17.02	11.62	6.72	3.72	2.49	7.93
7 p.m.	2.14	2.59	3.60	5.54	8.49	13.02	18.58	17.40	12.08	6.90	3.79	2.46	8.05
9 p.m.	2.08	2.52	3.58	5.47	8.41	12.93	18.56	17.33	11.82	6.74	3.70	2.37	7.96

PEKING.

Hourly Range of the Pressure of Aqueous Vapour.—Millimetres.—Table (260).
Mean of the years, 1868 and 1869.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
6 a.m.	1.80	2.26	2.76	5.20	8.64	12.90	17.54	15.53	10.62	6.84	3.28	2.10	7.46
8 a.m.	2.03	2.26	2.95	5.50	8.65	13.11	18.49	16.18	11.42	7.66	3.54	2.24	7.84
10 a.m.	2.61	2.92	3.00	5.54	8.28	13.21	18.34	16.19	11.54	8.14	3.92	2.56	8.02
Noon	3.00	3.12	3.15	5.59	8.26	13.27	18.39	16.32	11.61	8.16	4.09	2.60	8.13
2 p.m.	3.35	2.56	3.00	5.34	8.30	12.90	18.14	16.48	11.44	7.95	4.20	2.66	8.03
4 p.m.	3.38	2.59	3.05	5.10	8.37	12.52	17.68	16.00	11.34	7.81	4.25	2.54	7.89
6 p.m.	2.79	2.79	2.97	5.06	8.40	12.30	17.86	16.29	11.58	8.25	2.16	2.40	7.90
8 p.m.	2.56	2.49	3.07	5.31	8.66	12.50	17.73	16.34	11.53	7.76	3.84	2.28	7.84
10 p.m.	2.36	2.41	3.10	5.37	8.54	12.50	17.91	16.11	11.20	7.53	3.71	2.25	7.75

PEKING.

Hourly Range of the Relative Humidity.—Per cent.—Table (261).
Mean of Observations, made 1850-1855.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
Midnight	69.7	68.2	66.0	55.3	59.7	68.6	84.4	86.1	79.4	69.7	69.1	69.4	70.5

PEKING.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
1	70.2	67.7	67.7	57.1	61.2	70.3	85.7	87.2	80.0	71.0	70.4	69.9	71.5
2	70.2	69.0	68.7	58.4	62.7	72.1	86.7	88.1	80.9	71.3	70.8	70.4	72.4
3	70.7	70.1	69.7	60.3	64.9	73.4	87.6	88.8	80.9	71.6	70.7	70.2	73.2
4	71.3	70.0	70.0	61.9	66.7	74.6	88.3	89.1	81.0	72.3	71.1	70.2	73.9
5	71.8	70.3	71.0	63.8	67.6	74.8	88.6	89.0	81.6	72.3	71.8	70.5	74.4
6	71.4	69.6	70.7	63.7	64.8	71.7	86.0	87.5	80.5	73.2	72.0	70.4	73.5
7	71.0	70.5	69.8	59.8	60.9	68.0	82.2	84.0	77.9	70.8	71.6	71.1	71.5
8	71.0	69.2	64.8	55.7	57.1	64.2	78.5	79.9	72.9	66.3	68.8	69.8	68.2
9	66.5	64.5	58.9	51.0	52.6	59.6	74.9	75.0	67.1	59.8	63.5	64.7	63.2
10	63.3	61.1	54.7	47.1	48.9	55.4	71.8	70.9	63.0	55.4	59.1	59.8	59.2
11	61.4	57.2	51.3	43.5	45.8	52.1	68.5	67.7	59.5	51.7	55.4	58.0	56.0
Noon	58.9	54.4	48.6	41.1	44.2	50.0	65.3	65.7	56.9	49.4	52.6	55.6	53.6
1	57.0	51.5	46.5	38.4	42.2	48.0	65.0	63.8	55.5	47.7	51.7	53.8	51.8
2	55.9	50.6	44.4	37.4	41.1	46.8	63.2	63.1	54.7	46.3	50.5	52.5	50.5
3	56.2	50.9	43.9	36.4	40.5	47.0	63.1	62.9	54.7	46.5	51.1	53.8	50.6
4	57.5	51.0	44.3	36.9	41.3	47.8	63.6	64.2	56.5	47.9	54.5	57.3	51.9
5	62.5	53.7	47.0	39.0	42.2	49.6	65.3	66.6	60.6	53.4	59.8	61.4	55.1
6	64.8	57.0	50.2	41.0	44.6	52.4	68.6	70.3	66.7	59.7	63.5	64.7	58.6
7	66.6	61.2	54.9	45.7	48.6	56.6	73.0	76.4	71.1	62.7	66.1	66.8	62.5
8	67.2	63.2	57.7	48.7	52.1	60.3	77.8	79.7	73.3	65.1	67.5	68.0	65.0
9	68.1	64.4	60.7	51.3	54.6	63.2	80.4	82.0	75.1	66.2	67.8	68.5	66.9
10	68.0	66.0	62.6	52.8	56.5	65.2	81.7	83.4	76.7	66.9	68.6	69.0	68.1
11	69.1	67.4	64.6	54.3	58.2	66.5	83.5	84.4	78.3	68.3	68.5	69.6	69.4
Mean	65.8	62.4	58.7	50.0	53.3	60.8	76.4	77.3	70.2	61.9	64.0	64.8	63.8

PEKING.

Hourly Range of the Relative Humidity.—Per cent.—Table (262).

Mean of the years 1841-1855.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
5 a.m.	63.5	66.5	65.1	62.6	64.7	74.8	86.3	87.7	79.3	70.3	65.3	62.7	70.7
7 a.m.	63.2	66.3	64.0	59.7	59.3	69.3	81.5	83.7	76.5	69.3	65.0	62.7	68.4
9 a.m.	59.7	61.1	54.8	50.3	50.9	60.5	74.7	74.5	66.6	58.7	58.7	57.9	60.7
11 a.m.	54.5	53.8	47.3	42.9	44.5	53.4	68.4	67.6	58.6	50.2	49.9	51.9	53.6
1 p.m.	50.3	48.1	42.5	37.9	40.5	48.7	64.9	63.3	54.0	46.0	46.1	47.9	49.2
3 p.m.	48.7	46.7	39.8	35.7	38.5	47.6	63.4	62.5	52.5	44.7	45.0	47.5	47.7
5 p.m.	53.2	49.7	42.5	37.4	39.7	50.1	65.3	66.5	57.3	51.3	52.1	53.2	51.5
7 p.m.	58.3	56.7	49.5	44.1	46.1	56.4	72.3	75.1	67.8	60.9	58.3	58.5	58.7
9 p.m.	60.7	62.1	54.3	48.4	51.7	62.9	78.8	80.7	71.7	64.8	60.9	60.2	63.1

PEKING.

Hourly Range of the Relative Humidity.—Per cent.—Table (263).

Mean of the years 1868 and 1869.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
6 a.m.	64	64	62	66	67	76	86	86	84	77	70	68	72.5
8 a.m.	67	61	56	56	54	63	76	74	73	68	67	68	65.2
10 a.m.	65	55	45	44	44	54	65	61	58	54	56	59	55.5
Noon	61	47	38	37	38	47	58	56	53	48	49	50	48.5
2 p.m.	61	36	33	32	36	44	55	54	50	44	48	48	45.1
4 p.m.	66	37	34	33	37	46	54	56	52	46	54	50	47.1
6 p.m.	69	49	38	36	42	48	60	64	62	60	63	56	53.9
8 p.m.	70	52	46	46	52	58	69	74	70	64	65	60	60.5
10 p.m.	69	56	52	51	56	65	77	79	74	68	68	64	64.9

The hourly course of the relative humidity is simple, and closely related to the hourly course of temperature. In the morning, about the time of the minimum of temperature, the relative humidity reaches its maximum; and in the first hours of the afternoon, when the daily temperature is at its maximum, it arrives at its daily minimum.

The daily amplitude of the relative humidity is:—

PER CENT.

	Jan.	Feb.	Mar.	Apr.	May.	June.
At Nerchinsk...	...	...	...	19.°6	29.°5	32.°7
,, Peking	15.°9	19.°9	27.°1	27. 4	27. 1	28. 0

	July.	Aug.	Sept.	Oct.	Nov.	Dec.
At Nerchinsk...	29.°8	29.°3	30.°8	20.°0	...	...
,, Peking	25. 5	26. 2	26. 9	26. 9	21.°5	18.°6

and the daily amplitude of the temperature:—

	Jan.	Feb.	Mar.	Apr.	May.	June.
At Nerchinsk...	6.°8	8.°9	10.°5	10.°2	10.°8	11.°3
,, Peking	7. 4	8. 7	9. 7	10. 4	10. 7	10. 3

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
At Nerchinsk...	10.°3	10.°4	11.°0	9.°2	7.°5	6.°1	9.°4
,, Peking	7. 5	7. 6	8. 6	9. 9	7. 5	7. 5	8. 8

The hourly range of the pressure of aqueous vapour is more complicated than that of relative humidity. In the morning, at the time of the minimum of temperature, the pressure of aqueous vapour has likewise its principal minimum at all seasons; because, in consequence of the minimum of the temperature the air possesses the smallest capacity for the reception of aqueous vapour, and because the evaporation at the time of minimum of temperature is very slight.

When the sun rises higher, the course of the pressure of aqueous vapour becomes more complicated; for, the higher temperature not only enlarges the capacity of the air for receiving aqueous vapour, and the evaporation of the water in store at the station of observation, but also produces an ascending air current and horizontal currents, composing the daily period of the winds. The ascending current carries off every time a part of the specific light aqueous vapour in high regions, it diminishes every time the pressure of aqueous vapour; but the horizontal winds, produced by the daily period, elevate the pressure of aqueous vapour, if they come from a wetter country, and diminish the pressure of aqueous vapour, if they arrive from drier countries than the place of observation.

If Δ v represents the amount of aqueous vapour, produced by evaporation at the station during an unit of time, for instance during one hour,

Δ l the aqueous vapour carried off in high regions by the ascending current during one hour, and

Δ h the variation in the pressure of aqueous vapour, produced by horizontal air currents, composing the daily period of the winds, during one hour,

the variation Δ F of the pressure of the aqueous vapour at the station, during the unity of time, will be:—

$$\Delta\,F = \Delta\,v - \Delta\,l \pm \Delta\,h.$$

If the sum Δ F is positive, the pressure of aqueous vapour increases, if Δ F negative, it decreases.

Δ v, Δ l and Δ h are each subjected to a daily and annual period.

For our two places Nerchinsk and Peking Δ h may be put down as equal to zero, both places being situated within the continent and receiving, in consequence of the daily period of winds, air from a tract of country, having the same quality as themselves.

— Δ l is always negative and its value depends on the intensity of the ascending air current.

Finally Δ v is always positive and depends on the amount of temperature, the daily amplitude of temperature and the stock of water, existing on the surface of the earth near the station of observation.

During the winter, the ascending air current of the daily period, on account of the low temperature near the surface of the globe, on account of its slow decrease with the increase of the height over the sea-level and on account of the smallness of the daily amplitude of temperature, is feeble; therefore Δ l is small, and the daily period of the pressure of aqueous vapour depends principally only on Δ v; *i.e.* this daily period of pressure of aqueous vapour is closely related to that of the temperature; and consequently there occurs only one Minimum near the time of the minimum of temperature, and only one Maximum near the time of the Maximum of temperature. More complicated is the course of the pressure of aqueous vapour during the warmer nine months of the year, from March to November, where the annual amplitude of the amount of rain is considerable, as *e.g.* at Peking.

Then there occur daily two maxima and two minima of the pressure of aqueous vapour; the ascending air current during the

first hours of the afternoon having attained so great an intensity, that Δ l becomes greater than Δ v, *i.e.* that more aqueous vapour flows to higher regions, than will be produced by evaporation.

Hence at the hottest time of the day, when the ascending current is most intense, there appears after a maximum at noon a secondary minimum; and at evening, near seven o'clock, when it has become feeble, a second maximum.

This second maximum exists at Nerchinsk only during the months of May, June, July and August, and is lower than the maximum at noon; but at Peking the maximum at seven o'clock in the evening is only during the dry months, from April to June, when very little rain falls, lower than the maximum at noon; and during the wet months from July to October, when much rain falls, it is higher than that at noon.

In the above mentioned pamphlet "On the Climate of Peking by Dr. H. Fritsche" I have stated, that for Peking this difference in the daily course of the pressure of vapour during the two different warm parts of the year, from April to June and from July to October, must be attributed to the stock of water on the surface of the place (Peking.)

The proof has been based upon the observations, made every day nine times, from the morning at 6 o'clock till the evening at 10 o'clock, during 21 months from April 1868 to Dec. 1869.

This is shown by the fact that during the year 1869, an extraordinarily small quantity of rain having fallen, and in 1868 the quantity of rain having been little less than the normal annual mean, the difference between the dry (April-June) and the wet (July-October) season was very insignificant in relation to the stock of water on the surface of the station, and the moisture of the air; and in consequence of this, the hourly range of the pressure of aqueous vapour was the same in both seasons.

That at Nerchinsk, during all warm months, the hourly range of the pressure of vapour is very similar to that of the dry period (April-June) at Peking, must be explained, partly by the circumstance, that at Nerchinsk the difference in the fall of rain between June and July, and generally the fall of rain is not so great as at Peking; and partly by the quality of the surface of the region, the land surrounding Peking being a wide plain, where the water stands without movement for a long time after rain; and on the contrary Nerchinsk being situated between bluff mountain ranges, which do not permit a long stagnation of the water.

B.—ANNUAL PERIOD.

The tables (264) and (265), which contain the monthly means of the pressure of aqueous vapour, observed in Eastern Asia, show, that the principal element, determining the amount of the pressure of aqueous vapour is the temperature of the air.

For, in winter, at the time of the annual minimum of temperature all our places—(264), (265)—have their minimum of the pressure of vapour; and in summer, at the time of the annual maximum of temperature, they have their maximum of the pressure of vapour.

The annual maximum and minimum of temperature occurring on the islands of Eastern Asia about half a month later than on the continent, the maximum and minimum of the pressure of aqueous vapour, according to (264) and (265), occur likewise half a month later on the islands than on the continent.

The same remark has been made in comparing the results of the observations, for instance at Sitka (with a sea climate and at Halle (with a continental climate.)

The influence of the temperature on the amount of the pressure of aqueous vapour appears in the geographical distribution of the latter, increasing in a similar way to the temperature, from N. to S.

A second, independent, element determining the amount of the pressure of aqueous vapour is the wind, and the stock of water at the place, resulting from the wind.

For instance at Peking, according to our chart, there blow in spring, besides northern dry continental winds, southerly winds, which, though arriving from the sea-side, have already made a long passage over the land, and are probably in most instances deflected currents.

Falls of rain at Peking in spring are therefore of rare occurrence; and only towards the end of June the great summer rains begin to make their appearance; and thus, as I have already stated above, the warm season, from March to October is divided into two parts, the dry season, from March to June, and the wet season, from July to October.

The difference of these two periods, or the influence of the humid sea winds on the pressure of vapour, is seen on comparing such months of both seasons, the mean monthly temperatures of which are nearly the same; *e. g.* June with August (mean temperatures resp. 24°3 and 24°6), and May with September (mean temperatures resp. 19°9 and 20°1.) The dif-

ference of the pressure of aqueous vapour between August and June is equal to 16.83mm.—12.80mm.=4.03mm.: between September and May to 11.44mm.—8.34mm.=3.10mm.

Corresponding to the great annual amplitude of temperature, the annual amplitude of the pressure of aqueous vapour in Eastern Asia is considerable.

		Annual Amplitude of the pressure of aqueous vapour.	Annual Amplitude of the temperature.
268		mm.	
	Nikolajevsk	12.8	40.°7
	Urga	8.9	45. 4
	Nerchinsk	11.0	47. 2
	Peking	16.1	30. 7
	Taku	17.1	32. 2
	Tientsin	19.3	29. 4
	Shanghai	18.8	24. 6
	Bangkok	4.2	3. 9
269		mm.	
	Hakodate	13.5	24.°0
	Yedo	16.7	23. 6
	Yokohama	17.1	21. 5
	Osaka	16.0	23. 1
	Nagasaki	15.3	22. 9
	Decima	15.1	21. 7
	Manila	7.5	3. 9

In comparing the observations made at Bangkok and Manila, with those of Japan, we learn, that the annual amplitude of the pressure of aqueous vapour increases, as the annual amplitude of temperature increases.

But moreover the amount of the annual amplitude of the pressure of vapour will be determined by the temperature of the air, by the distance from the sea, and by the direction of the prevailing winds.

The influence of this last element (the wind) on the pressure of aqueous vapour and on its annual amplitude, I have explained by means of the Peking observations. The influence of the temperature itself, and of the distance from the sea, will be properly shown by the observations, made at Nerchinsk and Peking.

Though Nerchinsk is subjected to a greater annual amplitude of temperature—47° 2—than Peking—30° 7,—the former has a smaller annual amplitude of the pressure of aqueous vapour—11.0 mm.—than the latter—16.1 mm.

The first cause of this difference between these two places is the difference of the temperatures producing a different capacity of the air for the reception of aqueous vapour. For, according to the table

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Temperature.	Capacity for reception of aqueous vapour. mm.	Differences. mm.
30°	31.5	—14.1
20	17.4	
10	9.2	— 8.2
0	4.6	— 4.6
—10	2.1	— 2.5
—20	0.9	— 1.2
—30	0.4	— 0.5

The capacity of the air for the reception of aqueous vapour varies more rapidly, if the temperature is higher, than if the temperature is lower.

At Nerchinsk the mean monthly temperature in the course of a year varies between —29° 2 and 18° 0 and at Peking, between —4° 6 and 26° 1, therefore, according to table (270) the mean annual amplitude of the capacity for the reception of aqueous vapour at Nerchinsk is equal to 15 mm., but at Peking to 22 mm.

The second cause, which diminishes the annual amplitude of the pressure of vapour at Nerchinsk, in comparison with that of Peking, is, that the sea winds, bringing from the Pacific Ocean rain and moisture, in consequence of the overland passage they have made, have lost more of their original humidity, when arriving at Nerchinsk, than when arriving at Peking, which lies nearer to the sea than Nerchinsk.

Europe, where the annual amplitude of temperature is small, has only a small annual amplitude of the pressure of aqueous vapour, for instance:

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	Annual amplitude of the pressure of aqueous vapour. mm.	Annual amplitude of the temperature.
Tromsö.........	5.6	15° 7
Skudesnes ...	5.4	13 0
Dublin	5.7	11 7
Lisbon	6.2	13 5

Also in Europe and Western Siberia, as in Eastern Asia, the pressure of aqueous vapour reaches its annual minimum in winter and its maximum in summer.

In July, when in northern Asia and Europe, between the parallels of 40° and 60°, the temperature is nearly the same on the same latitude and on all longitudes, and even at some places in Northern Asia higher than in Europe, the pressure of aqueous vapour in the interior of Asia (for instance at Barnaul and Nerchinsk) is just as great as in warm and wet Europe under the same latitude; because, setting aside the fact that the temperature is nearly equal under the same latitude, moist air besides enters into the interior of Asia from the Atlantic, Arctic and Pacific oceans, in order to compensate for the vacuum caused by the ascending current.

On the parallel of 50°, in the Amoor-Territory, in July the pressure of vapour is about 12mm.; the very same as in Europe under the same latitude.

But northern China (*e.g.* Peking) has in July a greater pressure of aqueous vapour than southern Italy and Spain, situated nearly under the same latitude.

China and Japan, the former in July, the latter in August have on an average both a pressure of aqueous vapour, equal to 20mm., *i.e.* 8mm. more than more northern Europe.

During the winter the pressure of aqueous vapour in the Amoor-Territory is nearly equal to zero; the same is the case in Middle and Western Siberia; but in Western Europe it is greater, viz.: between 2 and 8 millimetres.

China, as we have stated above, is very dry during the winter, taking into consideration its low latitude: its pressure of aqueous vapour is between 2mm. and 8mm. (Peking and Fu-cheu-foo), it reaches, therefore, scarcely that of more northern Europe, and is smaller than that of Japan.

The annual mean of the pressure of aqueous vapour in the Amoor-Territory is between 4mm. and 5mm.; in Western Europe under the same latitude (about 47°) nearly 8mm.; the annual mean of North-China and Japan varies between 7mm. and 12mm., and differs little under the same latitudes in both countries.

Western Europe, therefore, possesses an annual mean pressure of aqueous vapour, nearly equal to that of Northern China. Though during the winter, in consequence of the continental dry winds, the pressure of aqueous vapour in Easrern Asia is very small, it is in consequence of the high temperature and sea-winds during the warm season so great, that the annual mean in China and Japan is nearly equal to that of S.W. Europe on the same latitude. This is, I believe, important for the vegetable life in Northern China and the Amoor-Territory,

where in spring rain is very scarce. But probably more important for the life of men, animals and plants than the pressure of aqueous vapour is the so-called relative humidity, the former representing the amount of aqueous vapour contained in the cubic unit of the air, and the latter the percentage of aqueous vapour, which it would contain, if it were saturated.

The annual maximum of the relative humidity occurs, according to tables (266) and (267), for the whole of Eastern Asia, in summer on the islands, as it seems, a little earlier than on the northern part of the continent; because the sea-winds, generating the annual maximum of the humidity, touch first the islands, and afterwards the continent.

The annual minimum of the relative humidity occurs, on the northern part of the continent, as far as the parallel of 35°, in April or May; and on the islands earlier, in February or March; the sea-winds touching earlier the islands than the continent and preventing during the spring a small amount of relative humidity on the islands; and the temperature rising, when the season has advanced from winter to spring, not so rapidly on the islands, as on the continent, where the high temperature of spring and absence of sea-wind produce the late minimum of relative humidity in April or May.

On the relative humidity of Southern China, Formosa and the Philippine islands, we do not possess many observations; and, with regard to the annual period of relative humidity, we are only able to state, that its annual amplitude there is smaller than in the northern parts of Eastern Asia.

The annual amplitude of relative humidity on the continent for the stations of Urga, Nerchinsk, Vladivostok, Peking and Shanghai is on an average equal to 22 per cent: on the islands for the stations of Hakodate, Yedo, Yokohama, Osaka, Nagasaki, Decima, Victoria and Manila on an average only to 15 per cent.

During the summer the relative humidity, as well on the continent as on the islands, is nearly 82 per cent; on the islands and the coasts of the continent a little greater than in its interior.

The annual minimum of relative humidity, appearing on the northern part of the continent in spring, is on an average of Urga, Nerchinsk, Vladivostok, Peking and Shanghai equal to 59 per cent; on the islands to 68 per cent. Especially in the interior of the Amoor-Territory and most northern China the mean monthly relative humidity in spring is very small, about 55 per cent, according to table (266), but the absolute minimum descends in spring often to less than 10 per cent [*e.g.* Peking,

table (266), 8 per cent]; and for weeks, the dryness of a desert reigns in these countries. Such low minima of relative humidity never occur in Western Europe.

The annual mean of relative humidity in the whole of Eastern Asia is nearly the same, namely, about 74 per cent, and does not differ much from that of Europe; in Northern China the annual mean of relative humidity is probably smallest, [*cf.* Peking, table (266)].

MONTHLY AND ANNUAL MEANS OF THE PRESSURE OF AQUEOUS VAPOUR.

MILLILETRES.

Continent of Eastern Asia.—Table (264).

	Jan. mm.	Feb. mm.	Mar. mm.	Apr. mm.	May. mm.	June. mm.	July. mm.	Aug. mm.	Sept. mm.	Oct. mm.	Nov. mm.	Dec. mm.	Annual Means. mm.	Number of years observed.	
Nikolajevsk..	0.6	1.1	2.6	3.5	5.6	10.2	13.4	11.3	8.4	5.1	2.2	0.8	5.3	2	Annals of the physical Observatory at St. Petersburg, 1866, 69.
Urga........	0.5	0.8	1.3	2.8	5.0	6.4	9.4	8.5	5.6	2.7	1.4	0.9	3.8	2	1872 and 1874.
Nerchinsk ..	0.42	0.62	1.49	2.83	4.37	8.28	11.41	9.91	6.04	2.95	1.21	0.53	4.17	26	Repert. IV, No. 7, p. 45.
Vladivostok..	..	1.6	1.9	4.4	6.4	9.8	14.4	16.3	10.4	6.2	..	..	..	$\frac{9}{12}$	1873, Annals of the physical Observatory at Petersburg 1874.
Peking......	2.02	2.44	3.47	5.46	8.34	12.80	18.15	16.83	11.44	6.37	3.53	2.29	7.76	19	Repert. IV, No. 7, p. 45.
Tientsin	2.5	3.2	4.9	7.9	11.2	17.0	21.8	18.2	15.0	8.9	4.5	3.8	9.9	1	1872.
Taku	2.9	3.5	4.5	6.7	10.2	15.3	20.0	19.3	13.3	8.0	4.6	3.6	9.3	3	1873-1875.
Shanghai....	4.4	5.6	6.8	8.0	12.4	18.0	23.2	20.9	16.8	11.1	7.4	4.5	11.6	1	April 1875—Mar. 1876, Observatory at Si-ka-wei
Fu-cheu-foo..	..	..	..	13.1	15.0	21.1	22.7	22.6	21.9	15.3	10.5	8.9	..	$\frac{9}{12}$	1870, 9 a.m., *Chinese Recorder*, 1870.
Bangkok	18.8	20.3	21.9	22.1	23.0	22.9	22.5	21.8	22.3	22.0	19.1	18.4	21.3	4	O. Z. VII, p. 23.

Islands of Eastern Asia.—Table (265).

	Jan. mm.	Feb. mm.	Mar. mm.	Apr. mm.	May. mm.	June. mm.	July. mm.	Aug. mm.	Sept. mm.	Oct. mm.	Nov. mm.	Dec. mm.	Annual Means. mm.	Number of years observed.	
Hakodate....	2.8	3.1	3.9	5.4	7.6	10.9	14.0	16.3	12.8	7.7	5.1	3.6	7.8	$4\frac{5}{12}$	1859-1868, Correspondance Meteor. par Kupffer, 1862.
Yedo........	3 6	3.7	5.0	8.0	11.1	15.0	19.0	20.3	16.1	11.0	6.7	4.7	10.3	2	Oct. 1872—Sept. 1874.
Yokohama ..	4 0	5.7	5.9	9 3	12.4	15 9	17.3	21.1	16.4	10.1	7.2	5.2	10.9	1	1865, O. Z. VII, p. 47.
Osaka	4.9	5.5	6.6	9.4	10.9	18.0	18.9	20.9	17.8	13.3	9.6	6.1	11.8	1	1870, O. Z. VI, p. 251.
Nagasaki....	5.2	5 0	7.5	12.0	12.2	15 4	20.3	19 3	16.1	11.7	8.3	6.9	11.7	1	1872, O. Z.
Decima	5.9	6.1	7.5	10.2	12.2	15.6	20.2	21.0	18 0	12.4	8.8	6.9	12.1	6	1815-1851, O.Z. VII, 47.
Kelung......	10 5	11.4	12.2	13.5	..	..	..	..	21.8	16.9	14.1	11.4	..	$\frac{8}{12}$	Jan.-April 1874 and Sept.-Dec. 1873.
Manila......	14.7	14.3	15.5	16.2	18.5	20.4	20.7	20.9	21.8	18.5	17.4	15 2	17.8	5	1865-69, O. Z. VIII, 334

MONTHLY AND ANNUAL MEANS OF THE RELATIVE HUMIDITY.

PER CENT.

Continent of Eastern Asia.—Table (266).

	Absolute Minimum.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed.	
Nikolajevsk..	..	81	86	89	94	98	90	86	88	89	90	86	81	88	2	Schrenck, Amur-Reise IV, p. 371.
Urga........	12	87	84	63	51	55	51	66	70	63	66	75	87	68	2	
Nerchinsk ..	..	74	73	72	63	55	66	75	78	73	70	74	73	71	26	Repertorium IV, No. 7, p. 46.
Vladivostok..	27	..	74	67	74	76	85	90	89	79	75	..	..	..	$\frac{9}{12}$	Annals of the phy. Obs. at St.Pet.1874
Peking......	8	58	59	54	49	51	61	76	76	68	60	58	58	61	19	My treatise, "On the Climate of Peking," p. 43.
Tientsin	19	70	71	72	71	63	74	77	73	73	67	72	75	72	1	1872.
Taku	..	93	87	73	61	61	66	78	74	73	74	75	91	75	3	1873-1875.
Shanghai....	18	85	84	77	71	74	89	83	83	84	77	78	80	80	1½	April 1875—March 1876.
Fu-cheu-foo..	..	..	..	..	85	80	77	78	76	87	71	69	73	..	$\frac{9}{12}$	1870, 9 a.m.

ISLANDS OF EASTERN ASIA.—Table (267).

	Absolute Minimum.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Means.	Number of years observed	
Hakodate		70	71	70	71	75	80	82	80	76	71	69	72	74	$4\frac{5}{12}$	1859-63, Corresp. Meteor. par Kupffer, [1862.
Yedo.......... ..		66	64	68	70	76	83	83	80	86	82	75	70	75	2	October 1872—Sept. 1874.
Yokohama		61	74	68	75	77	82	84	79	78	75	74	71	75	1	1865 O. Z. VII p. 47.
Osaka		70	68	68	76	73	90	77	80	81	87	79	70	77	1	1870 O Z. VI p. 251.
Nagasaki..... ..		70	67	68	81	69	76	79	74	74	67	66	69	72	1	1872
Decima		77	75	75	76	75	81	82	80	80	76	77	78	77	6	1845-1851, O. Z. VII, p. 47.
Kelung....... ..		88	89	90	82	..	..	..	..	87	81	82	79	..	$\frac{8}{12}$	Jan.-April 1874, Sept.-Dec. 1873.
Victoria		72	77	80	83	82	81	79	77	79	77	72	76	78	6	O. Z. VIII, p. 73.
Manila	28	78	77	72	71	71	79	83	84	85	86	81	79	79	4	O. Z. VIII, p. 334.

a.—PROBABILITY OF PRECIPITATION—(RAIN AND SNOW).

CONTINENT OF EASTERN ASIA.—Table (272.)

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Means.	Number of years observd.
Yakutsk	0.28	0.21	0.19	0.17	0.18	0.28	0 27	0.17	0.32	0.38	0.27	0.25	0.25	$3\frac{6}{12}$
Ayan	0.10	0.10	0.13	0.16	0.13	0.16	0.11	0.19	0.23	0.15	0.09	0.06	0.13	$4\frac{6}{12}$
Nikolajevsk ...	0.24	0 20	0.21	0.29	0.34	0.29	0.27	0.31	0.28	0.35	0.35	0.29	0.28	17
Urga	0.02	0.02	0.07	0.04	0.09	0.19	0.29	0.25	0.10	0.03	0.07	0.07	0.10	3
Nerchinsk......	0.09	0.11	0.14	0.19	0.27	0.36	0.47	0.49	0.33	0.16	0.22	0.17	0.25	17

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Means.	Number of years observd.
Vladivostok ...	0.10	0.07	0.13	0.30	0.42	0.40	0.35	0.32	0.23	0.06	0.10	0.10	0.22	1
Si-wan-tse ...	0.13	0.11	0.13	0.17	0.19	0.33	0.48	0.32	0.30	0.16	0.10	0.10	0.21	2
Kalgan	0.03	0.07	...	...	...	...	...	0.35	0.33	0.13	0.03	0.06	...	$\frac{7}{12}$
Newchwang...	0.05	0.04	0.15	0.25	0.34	0.25	0.42	0.29	0.18	0.10	0.17	0.14	0.20	2
Peking	0.08	0.10	0.13	0.14	0.22	0.35	0.44	0.35	0.25	0.11	0.09	0.07	0.19	23
Tientsin	0.00	0.00	0.00	0.13	0.07	0.13	0.19	0.19	0.10	0.07	0.03	0.03	0.08	1
Taku	0.06	0.04	0.05	0.11	0.20	0.24	0.35	0.19	0.13	0.10	0.04	0.04	0.13	3
Chefoo	0.39	...	...	...	...	...	0.39	0.23	0.13	0.00	0.30	0.32	...	$\frac{7}{12}$
Fu-cheu-foo ...	...	...	...	0.37	0.79	0.17	0.39	0.23	0.43	0.26	0.20	0.07	...	$\frac{9}{12}$
Canton	0.19	0.25	0.35	0.40	0.52	0.47	0.25	0.45	0.35	0.16	0.13	0.22	0.31	10
Bangkok	0.04	0.13	0.16	0.31	0.60	0.61	0.57	0.59	0.66	0.45	0.26	0.12	0.37	9

ISLANDS OF EASTERN ASIA.—Table (273.)

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Means.	Number of years observd.
Dui	0.39	0.38	0.33	0.37	0.39	0.32	0.25	0.33	0.37	0.34	0.52	0.46	0.37	$4\frac{6}{12}$
Hakodate	0.55	0.46	0.42	0.38	0.34	0.31	0.43	0.42	0.43	0.41	0.46	0.61	0.43	$12\frac{6}{12}$
Niigata	0.50	0.25	0.23	0.23	0.11	0.27	0.16	0.18	0.33	0.19	0.36	0.45	0.27	2
Yokohama ...	0.14	0.22	0.27	0.32	0.27	0.38	0.32	0.30	0.39	0.23	0.22	0.14	0.28	7
Nagasaki	0.35	0.31	0.29	0.50	0.26	0.43	0.35	0.39	0.37	0.35	0.30	0.32	0.35	1
Kelung	0.74	0.64	0.55	0.47	0.45	0.23	0.23	0.52	0.60	0.58	0.40	0.35	0.48	2
Victoria.........	0.06	0.20	0.29	0.28	0.47	0.62	0.54	0.47	0.43	0.25	0.11	0.07	0.32	$11\frac{6}{12}$
Manila	0.21	0.23	0.13	0.14	0.23	0.57	0.68	0.62	0.79	0.56	0.32	0.26	0.39	5

b.—NUMBER OF DAYS WITH PRECIPITATION—(RAIN AND SNOW).

Continent of Eastern Asia.—Table (274).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Y'rly Sum
Yakutsk	9	7	6	5	6	8	8	5	10	12	8	8	92
Ayan	8	3	4	5	4	5	3	6	7	5	3	2	50
Nikolajevsk	7	6	7	9	11	9	8	10	8	11	10	9	105
Urga	1	1	2	1	3	6	9	8	3	1	2	2	39
Nerchinsk	3	3	4	6	8	11	15	15	10	5	7	5	92
Vladivostok	3	2	4	9	13	12	11	10	7	2	3	3	79
Si-wan-tse	4	3	4	5	6	10	15	10	9	5	3	3	77
Kalgan	1	2	...	...	...	...	...	11	10	4	1	2	...
Newchwang	1	1	5	8	11	7	13	9	5	3	5	4	72
Peking	2	3	4	4	7	11	14	11	8	3	3	2	72
Tientsin	0	0	0	4	2	4	6	6	3	2	1	1	29
Taku	2	1	2	3	6	7	11	6	4	3	1	1	47
Chefoo	12	...	...	...	...	...	12	7	4	0	9	10	...
Fu-cheu-foo	...	...	...	11	25	5	12	7	13	8	6	2	...
Canton	6	7	11	12	16	14	8	14	10	5	4	7	114
Manila	1	4	5	9	19	18	17	19	20	14	8	4	138

Islands of Eastern Asia.—Table (275).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Y'rly Sum.
Dui	12	11	10	11	12	10	8	10	11	10	16	14	135
Hakodate	17	13	13	11	11	9	13	13	13	13	14	19	159
Niigata	15	7	7	7	3	8	5	6	10	6	11	14	99
Yokohama	4	6	8	10	8	11	10	9	12	7	7	4	96
Nagasaki	10	9	9	15	8	13	11	12	11	11	9	10	128
Kelung	23	18	17	14	14	7	7	16	18	18	12	11	175
Victoria	2	6	9	8	15	19	16	15	13	8	3	2	116
Manila	6	6	4	4	7	17	21	19	24	17	10	8	143

On the continent of Eastern Asia—except its most northern part *e. g.* Yakutsk, where the probability of precipitation is nearly the same in every month—the probability of precipitation, according to table (272), reaches its maximum in summer and its minimum in winter.

The stations of Ayan and Nikolajevsk, situated near the coast of the sea of Okhotsk, show only a feeble annual period; its annual amplitude is only 0.13 or 4 days, while the annual amplitude of all other places, contained in tables (272) and (274), is on an average 0.40 or 12 days.

The annual periodicity of the monthly sum of days with precipitation on the western coasts of Saghalin, Yesso, Nipon and Kiusiu, which are turned towards the continent, is contrary to that of the continent, the maximum occurring in winter and the minimum in summer.

The cause of this must be found in the warm water current along the West-coasts of these islands, called the Tsusima stream, and in the continental cold N. W., W. and N. winds, which by their coldness precipitate the aqueous vapour generated by the warm Tsusima-stream and drive the aqueous vapours into the interior of the islands.

In consequence of this, on the western coast of Saghalin and Japan snow falls are frequent in winter; for in January the isothermal line of the freezing point touches the western and northern coast of Nipon, and cuts through the northern part of that island.

However, these snow falls, though twice as frequent as the summer rains coming from S. and S. E., contain much less water than the summer rains, as the observations at Hakodate show, table (277.)

For the eastern coast of Saghalin, of Yesso and of Nipon as far south as the cape of Daihosaki we possess no observations. Probably the periodicity of the number of days with precipitation within the different months, is there the same as at Yokohama and on the continent; *i. e.* the minimum occurs in winter and the maximum in summer.

On Formosa and the Philippines, surrounded on all sides by warm water, the probability and amount of precipitation depend much on the topographical position of the station: whether the wind, coming from the sea, touches the station direct, or whether it must first pass over mountains.

For instance, Kelung, situated on the N. E. corner of Formosa immediately on the sea, has in winter, when the wind blows ordinarily from N. E., the greatest number of rainy days;

On the continent of Eastern Asia—except its most northern part *e. g.* Yakutsk, where the probability of precipitation is nearly the same in every month—the probability of precipitation, according to table (272), reaches its maximum in summer and its minimum in winter.

The stations of Ayan and Nikolajevsk, situated near the coast of the sea of Okhotsk, show only a feeble annual period; its annual amplitude is only 0.13 or 4 days, while the annual amplitude of all other places, contained in tables (272) and (274), is on an average 0.40 or 12 days.

The annual periodicity of the monthly sum of days with precipitation on the western coasts of Saghalin, Yesso, Nipon and Kiusiu, which are turned towards the continent, is contrary to that of the continent, the maximum occurring in winter and the minimum in summer.

The cause of this must be found in the warm water current along the West-coasts of these islands, called the Tsusima stream, and in the continental cold N. W., W. and N. winds, which by their coldness precipitate the aqueous vapour generated by the warm Tsusima-stream and drive the aqueous vapours into the interior of the islands.

In consequence of this, on the western coast of Saghalin and Japan snow falls are frequent in winter; for in January the isothermal line of the freezing point touches the western and northern coast of Nipon, and cuts through the northern part of that island.

However, these snow falls, though twice as frequent as the summer rains coming from S. and S. E., contain much less water than the summer rains, as the observations at Hakodate show, table (277.)

For the eastern coast of Saghalin, of Yesso and of Nipon as far south as the cape of Daihosaki we possess no observations. Probably the periodicity of the number of days with precipitation within the different months, is there the same as at Yokohama and on the continent; *i. e.* the minimum occurs in winter and the maximum in summer.

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For instance, Kelung, situated on the N. E. corner of Formosa immediately on the sea, has in winter, when the wind blows ordinarily from N. E., the greatest number of rainy days;

a in summer, when the wind comes from S.W., the smallest; because the N. E. side of Kelung is in direct contact with the sea, whilst on t e S. W. are high mountains, which condense considerable quantities of the vapour brought by the S.W. wind from the sea. Manila has, on e contrary, the greatest number of rainy days in summer, and the smallest in winter; because it has on its N.E. side mountains, and on its .W. the sea.

The annual sum of days with precipitation in the Amoor-Territory and Northern China is about 75; in Southern China, being a mountain nd of nearly 900 metres height above the sea-level, and being overflowed by sea winds not only in summer, but also in spring and autumn, ore than 100.

In Western Europe the probability of precipitation for the whole year or the annual sum of days with precipitation is twice that of the moor-Territory and Northern China, and is not subject to so great a periodicity: *i.e.* the number of days with snow or rain in Europe is much ore equally distributed through the different months of the year, than in the Amoor-Territory (especially in its interior) and in Northern China.

On the islands of Eastern Asia the probability of precipitation for the whole year is double that of the Amoor-Territory and China: erefore scarcely as great as that at Western Europe, where it is equal to 0.45 or 164 days.

c.—AMOUNT OF PRECIPITATION.—MILLIMETRES.

Continent of Eastern Asia.—Table (276).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Sum.	Number of years observed.	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
kutsk	9.1	6.1	8.4	8.4	17.8	38.1	26.7	35.9	25.4	41 7	17.6	17.6	252.8	$2\frac{6}{12}$	Wesselofsky "On the Climate of Russia," p. 224.
an	13.0	9 6	9.6	11.0	52.3	49.8	98.0	228.9	262.4	99.8	32.3	13.5	880.2 ?	4	,, ,, ,, ,, p. 312.
kolajevsk ..	11.4	4.2	17.5	34.6	36.0	43.5	37.3	30.9	65.0	15.7	31.0	3.8	330.9	4	Schrenck, Amur-Reise, T. IV.
ga	0.6	2.3	2.3	0.5	15.2	57.5	71.9	63.3	18.5	2.1	2.3	2.0	238.5	4	1870, 71, 72 and 74.
rchinsk ..	2.2	1.7	5.3	12.0	26.7	63.9	100.1	106.0	52.8	11.8	7.5	3.4	393.4	27	O. Z. VI, p. 195, July, corrected by myself.
-wan-tse ..	..	..	8 4	10.3	23.0	93.8	187.6	89.5	48.8	..	..	..	(461.4)	$1\frac{2}{12}$	1874 and 1875.
wchwang ..	1.3	1.5	0.0	6.4	95.0	46.7	213.1	102.1	33.8	25.4	8.7	3.1	537.1	$\frac{11}{12}$	1862; 8,7mm., Nov., taken from Peking.
king	2.8	5.1	7.1	14.0	42.1	89.4	237.2	152.1	73.0	17.5	8.7	2.9	651.9	23	1841-74.
entsin	0.0	0.0	0.0	25.4	15.9	75.8	130.9	160 7	47 4	6.9	3.7	0.9	467.6	1	1872.
anghai	73	80	106	133	122	151	116	147	153	65	94	12	1252	6	O. Z. last volume.
-cheu-foo ..	..	..	..	60	251	56	135	..	..	..	..	..	..	..	*Chinese Recorder*, 1870.
nton	17	43	55	144	301	282	197	252	277	140	62	25	1795	..	O. Z. VIII, p. 219.
igon	0.0	0.0	4.6	16.9	127.3	196.5	214.9	194.2	427.1	184.6	115.4	2 3	1483.8	1	O. Z. VII, p. 23.
ngkok	4.8	13.7	37.9	103.6	235.0	204.0	178.3	180.8	312.9	181.3	84.8	19.1	1556.2	7	O. Z. VII, p. 23.

Islands of Eastern Asia.—Table (277).

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Sum.	Number of years observed.	
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm		
tropaulovsk.	88.2	135.6	203.7	172.7	72.1	53.1	25.4	44.4	156.8	157 5	105.7	214.7	1430.9	2	1848-49, Wessel. "On the Clim. of Russia," p. 225.
akodate	48.2	58 9	55.9	60.4	99.6	80.0	192.3	101.6	104.5	89 2	99.3	117.4	1107.3	$4\frac{5}{12}$	1859-63, Corresp. Meteorologie par Kupffer, 1862.
do	61.0	52.6	132.3	107.3	108.0	267.3	106.4	146.8	360.8	233.0	144.2	57.7	1777.4	2	October 1872—September 1874.
kohama ..	60	84	128	167	148	208	209	170	259	176	88	97	1794	7	1863-69, O. Z.
nagawa....	107	0	0	670	0	0	713	0	0	375	0	0	1865	1	1860, O. Z. VI, p. 252; the four seasons.
aka	47.3	37.7	38.8	93.9	129.2	72.5	126.7	86.9	144 8	172.5	67.0	36.5	1053.8	1	1870, O. Z. VI, p. 251.
gasaki	26.9	59.0	89.4	280.3	124.0	143.8	66.1	145.6	140.4	23 9	44.4	67.8	1211.6	1	1872, O. Z.
ecima	39.5	25.1	81.3	13.5	53.6	113.7	90.1	22.1	29.8	16.4	39.1	6.2	530.4 ?	2	1853-55; Meteor. Waarnemingen in Nederland, &c.
elung	572	301	272	292	302	113	95	219	384	206	130	164	3050	2	September 1872—August 1875. [1856.
ictoria......	10	37	65	93	241	436	360	318	354	144	74	16	2148	..	Mean from Victoria Hospital and Royal Engineers,
ictoria Peak..	6	59	61	32	334	359	184	423	297	178	82	6	2021	$2\frac{4}{12}$	O. Z. [O. Z. VIII, p. 219.
acao	15	41	53	117	307	274	183	252	269	155	61	28	1755	16	1812-14, 1819-31, O. Z. VIII, p. 219.
auila	27	36	15	29	106	241	289	398	586	247	120	29	2123	8	O. Z. VIII, p. 334.

ABSOLUTE VARIABILITY OF THE AMOUNT OF PRECIPITATION.—Table (278).

	Jan.	Feb.	Mar.	Apr.	May.	June.
	mm.	mm.	mm.	mm.	mm.	mm.
Nerchinsk	13	6	25	39	69	169
Peking	29	28	27	56	104	195

	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
Nerchinsk	164	267	112	50	19	10	...
Peking	497	347	286	46	32	20	822

On all places of the continent—table (276)—the most abundant precipitation occurs during the warm season; and very little during the colder.

A similar distribution of the precipitation through the different months of the year takes place on Yesso, Nipon, Sikok, Kiusiu, Victoria and Macao.

At Kelung, in consequence of circumstances above explained, the monthly sum of rain reaches its annual maximum in winter and its minimum in summer; and Manila has the same annual rain period, as the continent i. e. the greatest mass of precipitation occurs in summer and very little in winter.

To this coincidence of great warmth and considerable amount of rain must be attributed the fertility and culture of China and Japan.

We learn from table (276), that during the winter on the whole continent of Eastern Asia, and at Victoria, Victoria Peak and Macao, situated near the continent, the monthly sums of precipitation differ very little from each other, for the minima during the winter vary only between 0mm. and 17mm.

The winter minima [cf. table (277) on the Japanese islands are greater; namely, putting aside the dubious observations at Decima, between 27mm. and 60mm.

The summer maxima, on the contrary, increase in general considerably from North to South, being in the northern parts of the "Amoor-Territory"—Nikolajevsk, Urga, Nerchinsk—nearly equal to 80mm., at Si-wan-tse (latitude 41°) to 188mm., at Peking to 237mm, and at Macao to 307mm (latitude 23°.) On the Japanese islands we encounter nearly the same summer maxima of rain as on the continent under the same latitude.

The monthly range of the monthly sum of precipitation in

the North of the continent and on the northern islands differs from that of Middle-and South-China and South-Japan. Ayan and Nikolajevsk, situated near the coast of the sea of Okhotsk, according to table (276) reach their annual maximum only towards the end of the summer, viz. in September; the more southerly places Urga and Nerchinsk have their maximum between July and August i. e. earlier; the most southern parts of the Amoor-Territory (Si-wan-tse and Newchwang), the most northern part of China and Japan (Peking, Tientsin and Hakodate) in July. But in Middle and Southern China (Shanghai, Canton, Victoria Peak, Macao) in India beyond the Ganges (Bangkok) and Southern Japan there occur during the warm rainy season April-October, two maxima and one minimum of the monthly sum of rain.

The first maximum appears in May or June, the minimum in July and the second maximum in the beginning of September.

The minimum of July is secondary, it is much greater than the winter minimum.

The above explained variation of the monthly sum of precipitation in Eastern Asia with the season and geographical position will not be difficult to understand by means of our wind charts and the orographical peculiarities of the land of Eastern Asia.

The amount of the precipitation in winter, as the Chart shows, must be in Eastern Asia in general very small, because the winds blow uninterruptedly from the cold central region of the anticyclone of the dry Inner Asia, where the air has a descending movement into relatively warmer and lower countries, and because the temperature in Eastern Asia is very low. During the spring, (cf. chart), Eastern Asia is divided into two parts: in one part in Southern China, Southern Japan, at Manila and India beyond the Ganges, there prevail E. and S.E. winds from the sea; in the other part of Eastern Asia i. e. in the Amoor-Territory (except the mouth of the river Amoor) and in Northern China, there prevail continental N. and N.W. winds.

During spring therefore in Southern China, Japan and India beyond the Ganges, where the high mountain ranges will be touched nearly perpendicularly to the direction in which they themselves stretch, (S. W. to N. E. and S. to N.) by the E. and S. E. winds, coming from the sea, rain falls in abundance and the monthly sum of rain reaches its first annual maximum.

During the same period, the amount of precipitation in the Amoor-Territory and Northern China is still very small, though a little greater than during the winter; because the prevailing N. and N. W. winds are sometimes interrupted by sea winds.

In summer, according to chart, in the whole of Eastern Asia much rain must fall. In its north-western parts, the Amoor-Territory and Northern China, the rain fall reaches then or towards the end of summer its single annual maximum; but in Southern Japan, Southern China and India beyond the Ganges its quantity is less than in spring, because the prevailing winds, being S. and S. W., are on the one hand partly land winds, and on the other hand their direction is oblique or nearly parallel to the direction of the mountain ridges of these countries.

Hence in Southern China, Southern Japan and India beyond the Ganges, the secondary, second minimum of the quantity of rain in July takes its origin.

The wind system during the autumn, according to chart, resembles that during spring; hence the decrease of the amount of precipitation in autumn from month to month in the Amoor-Territory and Northern China, and the second maximum of the amount of precipitation in Southern China, Southern Japan and India beyond the Ganges.

Exceptions from these general laws in Eastern Asia happen on islands; for instance on Formosa and the Philippines, where, as I have explained above, the geographical position forms the decisive element with regard to the season in which the falls of rain are most heavy.

In the northern part of the Amoor-Territory (Nikolajevsk, Urga, Nerchinsk) the annual amount of precipitation is from 200 to 400 millemetres; in Southern Amoor-Territory and Northern China from 600 to 700 millemetres; in Middle China (Shanghai) about 1,300 and on the southern frontier of China and India beyond the Ganges about 1,600 millemetres. On the islands the annual amount of precipitation, near the same latitudes, is greater than on the continent. The most northern part of China (Peking) has only 653 millemetres, but Hakodate, though situated one degree more north, has almost double.

Further, Shanghai (latitude 31°) has the annual sum of 1,252 mm., but the southern coast of Japan (latitude 34°) has,

on an average of the five places of Yedo, Yokohama, Kanagawa, Osaka and Nagasaki, 1,540 millemetres.

Finally, on the islands, situated south of the 30th parallel, at Kelung, Victoria, Macao and Manila, we encounter annual sums of precipitation above 2,000 mm., while on the opposite continent the corresponding number is only 1,600mm.

The annual amount of precipitation in Ireland is more than 1,000mm., therefore scarcely equal to that of Middle China (Shanghai.)

East of Ireland, on the same latitude, the annual sum of precipitation decreases: in Northern Germany it is 600-700mm., about the same as in the most northern part of China (Peking.)

Further towards the East the annual sum of precipitation decreases still more; and at Barnaul and Urga, in the interior of Asia, it is only 200-300mm. From thence eastwards the sum increases and becomes at Nerchinsk and the lower Amoor river 400 millimetres. Though in some places of Southern Japan, Southern China, Formosa and Philippines there fall yearly more than 2,000 millimetres of rain, no yearly sums have been observed there as great as in India within the Ganges, where the rainfall reaches at some places the enormous amount of 5,500 millimetres.

The absolute variability of the amount of precipitation from one year to another i. e. the difference between the highest and lowest monthly or annual sum of rain, observed during a long series of years, in the Amoor-Territory and in Northern China, is very great; at Nerchinsk and Peking, as table (278) shows, greater than the many yearly mean of the monthly or annual sum, the numbers of table (278) being greater than the corresponding numbers of table (276.)

In Southern China, on Japan, Formosa and the Philippines, the absolute variability of the monthly and annual sums of precipitation is probably smaller than in the northern part of the continent of Eastern Asia, the Amoor-Territory and Northern China as far as the parallel 35°; because the former countries lie nearer to southern and warm seas, are overflowed by sea winds during a longer period, and are besides in part more mountainous and higher than the Amoor-Territory and Northern China.

While therefore in Northern China and the Amoor-Territory bad harvests are of not infrequent occurrence, in Southern China, Japan, Formosa and the Philippines bad harvests, in consequence of want of rain, are very rare.

NUMBER OF DAYS WITH SNOW.

279	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.	Number of years observed.
Vladivostok......	3	2	2	2	1	0	0	0	0	0	3	3	16	1 1874, O. Z. X.
Peking	2.4	2 9	2.6	0 4	0	0	0	0	0	0	0.9	1.9	11.0	14 1851-1875.
Hakodate	15.5	10.8	8.0	2.5	0	0	0	0	0	1.2	4.9	12.5	55.4	8 1860, 1864-1870, O Z. VI, p. 252.
Niigata	12 5	5.0	3.5	0	0	0	0	0	0	0	2.0	9.0	32.0	2 1870-71, O Z. VIII, p. 236. Snow and
Yokohama	1.5	2.0	1.0	0	0	0	0	0	0	0	0	0.5	5.0	2 1860 and 1864, O. Z. IX, p. 62. [Hail.

NUMBER OF DAYS WITH HAIL.

280	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.	Number of years observed.
Peking	0	0	0	0.04	0	0.13	0.13	0.18	0.09	0 04	0.0	0.0	0.57	23 1841-1874.
Jekaterinenburg	0	0	0	0.1	0.5	0.8	1.3	0.6	0.1	0.0	0 0	0 0	3.4	14 Wesselofsky "On the Climate of Russia."
St. Petersburg...	0	0.2	0.2	0.2	0.2	0 1	0 2	0.2	0.2	0.1	0.0	0 0	1.6	14 " " " "
European Russia	0.03	0.04	0.06	0.27	0.52	0.54	0.33	0.30	0.38	0.25	0.09	0.03	2.8	200 " " " "
Germany	...	...	...	...	...	...	...	...	...	...	...	...	5	... Kämtz.
Western Europe.	...	...	...	...	...	...	...	...	...	...	...	...	15	... "

NUMBER OF DAYS WITH FOG.

281	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.	Number of years observed.
Vladivostok......	1.0	0.0	1.5	2.0	3.0	13 0	10.0	8.0	...	...	...	...	...	$1\frac{4}{12}$ 1871 and 1874.
Peking	0.3	0.6	1.4	0.6	0.3	0.4	2.4	2.1	1.0	2.0	1.4	0.6	13.1	7 1869-1875.
Hakokate.........	0 0	0.1	0.4	0.3	0 7	2.4	1.7	0.3	0.0	0 0	0.0	0.0	5.9	7 1864-1870, O. Z. VI, p. 252.

NUMBER OF DAYS WITH THUNDER-STORMS.—(THUNDER AND LIGHTNING).

282	Jan.	Feb.	Mar.	Apr.	May.	Jun.	July.	Aug.	Sep.	Oct.	Nov.	Dec.	Year.	Number of years observed.
Irkutsk	0.0	0 0	0.0	0.0	1.0	1.0	4 5	2.0	0.0	0.0	0.0	0.0	8.7	...
Nerchinsk	0.0	0 0	0 0	0 3	0.3	3 1	0.2	0.5	0.5	0.0	0.0	0.0	4.9	...
Newchwang ...	0.0	0.0	0.0	0.0	2.0	8 0	2.0	2.0	0.0	0.0	1.0	0.0	15.0	1 1862.
Peking	0 0	0.0	0.0	0.7	3.0	6.6	6.9	5.6	3.7	0 4	0.0	0.0	26.9	7 1869-1875.
Niigata	0.0	0.0	0.0	0.0	1.0	0.5	3.0	3.0	3.0	0.5	0.5	0.5	12.0	2 1870 and 1871, O. Z. VIII, p. 236.

Table (279) shows, that the number of days with snow is greatest on the eastern coast of the Japan sea, because, as I have already mentioned in discussing the probability of precipitation, on this coast the cold N. W. winds of the continent mix with masses of air, provided by the Tsusima-stream with warm aqueous vapours. The snow-falls reach probably in the northern parts of the east coast of the Japan sea (Hakodate) some feet in depth.

With regard to the amount of snow in Eastern Asia, next to the eastern coast of the Japan sea, there probably come the eastern coasts of Saghalin, of Yesso, of northern Nipon, the mouth of the Amoor river and the shores of the sea of Okhotsk.

In the interior of the Amoor-Territory and Northern China snow falls seldom and in small quantities; so, that at Nerchinsk, Kjachta and on the upland Gobi (Urga) a snowy road is scarcely ever seen.

In Northern China the small quantity of snow which falls, rests during some weeks unmelted only upon the mountains; on low plains there it is melted in few days by the sun.

According to the Peking observations during 23 years, contained in table (280), it very seldom hails in Northern China: every two years hail falling only one time.

Further, it hails only during the warm months, never during the winter.

We find the same distribution of hail in different months, according to table (280), in Western Siberia and Russia, but there and in Germany and Western Europe hail is observed more frequently than in the plain of Northern China.

Fogs appear in all seasons, most frequently at the time of the heavy summer rains, when the air is near its dew point and southern and south-eastern sea winds bring wet air to more northern and higher situated regions.

During the winter as well as during the summer, on the coasts of the continent and on the islands, fog will be more frequent than in the interior of the continent of Eastern Asia; but most frequent during the summer over the northern seas.

That the latter statement is correct, we see from the observations at Vladivostok, table (281), which are made not on the land but on the sea itself, near Vladivostok.

That fog on the whole of Eastern Asia is less frequent in winter, than in summer, is not difficult to explain. Though in winter the seas of Eastern Asia are warmer than the cold and dry air, coming by N., N. W. and W. winds from the interior of the continent [cf. the above arranged tables (148) and

(149)]; and although, in fact fogs are sometimes produced over the sea and on the coasts in consequence of this, their frequency must be diminished by the great dryness of the continental air of the N., N. W. and W. winds, and by the circumstance, that this cold air passes into warmer and partly lower regions, where its relative humidity will be decreased in consequence of the higher temperature.

During the summer, on the contrary, S. and S. E. winds bring wet and warm air from southern warm seas to more northern, and partly higher, therefore cooler countries; consequently the relative humidity and also the number of fogs will be increased.

Thus fogs are most frequent on the sea of Japan and Okhotsk, whose water, according to tables (148) and (149), is during the summer cooler than the air, reposing upon them.

For the most part the land (islands or coasts of the continent) is not touched by the fog of the sea, being hotter than the sea. A track of water, near the coasts and the bays is also exempt, in consequence of the radiating caloric of the dry land, from the fog, which stands ordinarily upon the water just like a wall.

Ordinarily, according to our table (282), in Eastern Asia the frequency of thunder-storms (thunder and lightning) increases from N to S.; and this phenomenon occurs in northern countries, where the temperature of January falls below the freezing point, only during the warm season.

For Southern China and Japan we have unfortunately no observations; but it is probable, that the frequency of thunder-storms is greater there than in Northern China and Amoor-Territory, considering the greater quantity of rain itself.

The number of thunder-storms on an average seems to be smaller in Eastern Asia, than in Western Europe under the same latitude.

VI.—CONCLUSION.

Concluding my detailed exposition of the Climate of Eastern Asia I will essay to trace in a few words the principal and most characteristic lineaments, by which the climate of the three countries Amoor-Territory, China and Japan* is distinguished.

* Remark.—According to the explanation, given in the chapter "Absolute Maxima and Minima of the temperature," the expression Amoor-Territory in this work signifies a climatological district, which includes the

As the lowest stratum of the Atmosphere receives and loses the greatest part of its warmth, not by the direct influence of the sun and the celestial space, but by radiation and contact with the surface of the earth; and as differences of temperature are the starting point of all meteorological changes in the atmosphere, the principal elements, determining the climate of any part of the globe are two, viz:

(1). The latitude or the height of the sun above the horizon; because the higher the sun, the greater the number of its rays which touch an unit of the earth's surface, and the smaller the loss, caused by the passage of the rays through the atmosphere.

(2). The nature of the object, receiving the sun's rays; or in this case the distribution of dry land and water; the dry land becoming quickly hot by insolation, and quickly cold by radiation, producing therefore extreme temperatures of the air, resting upon it; but water becoming warm very slowly by insolation, and also very slowly cold by radiation, therefore diminishing the range of the temperature of the air and blunting the extremes. Asia is the *greatest* of all continents of the globe, is almost without lakes in its interior, and extends throughout almost all latitudes, from the Equator to the parallel of 80°.

Asia in relation to meteorological phenomena must be regarded as a great island, surrounded by the Arctic, Pacific, and Indian Oceans, the Gulf of Persia, the Caspian Sea and the Ural Mountains.

The influence of this colossal land mass on the climate of itself and the adjacent countrias is considerable in *all* seasons, both during the cold and warm months of the year.

The cold of the winter in Asia, produced mainly by radiation from this dry and immense continent into space, is extraordinarily great, greater than in any other country on the same latitude.

For instance, as I have stated above, in the Amoor-Territory the mean temperature of January is 28 degrees Celsius (50°

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island of Saghalin and the continent of Eastern Asia between the parallels of 40° and 60°, the Pacific Coast and the meridian 100° E. fr. Greenwich; or Eastern Siberia around the river Amoor and around its tributary streams, Eastern Mongolia (to the south as far as the great wall of China), Manchuria and the northern part of Corea.

Further the expression China in this work signifies China proper, beginning with the great wall of China, near the latitude of 40° and ending with the parallel of 20°.

The expression Japan in this work signifies, as usually, the islands Yesso, Nipon, Kiusiu and Sikok.

Fahrenheit) lower than in Western Europe, and about 10 degrees Celsius (18° Fahrenheit) lower than the Eastern coast of North-America on the same latitude, and at the same height over the sea.

The winds, blowing during the winter carry the cold and dryness of the interior of Asia to its circumference, spreading this cold and dryness over all parts of Eastern Asia, and over the islands and adjacent seas, so that even near the Tropic of Cancer, as at Canton, on the sea-level, the temperature sometimes sinks to the freezing point, and even snow falls.

In Eastern Asia, even on the islands, where the cold W., N.W. and N. winds must have lost a quanty of their inner-Asiatic coldness, the mean temperature of January is so low, that, for instance, an Englishman, if in Eastern Asia he would encounter the same mean temperature of January as in his native country, must go twenty degrees of latitude more to the South (viz.: to Southern Japan).

The summer of Eastern Asia is, also on account of the prevailing influence of the vast continent, very warm, warmer than that of N.E. America, and nearly as warm as that of Western Europe on the same latitudes.

The greatest number of plants being indifferent in regard to all temperatures lower than the freezing point, and their life depending, besides other circumstances (mainly moisture), only on the sum of the mean daily temperatures *above* the freezing point during the warm season; it is the same, if, *e.g.* the mean temperature of January be—40° Celsius or—10° Celsius, if only the summer be warm.

Eastern Asia, therefore, having a warm summer, is in a favourable situation in regard to this important meteorological element; the temperature, being a force, working upon the plants, as steam upon a machine.

The non-periodic, irregular fluctuation of the mean temperature from one year to another is in Eastern Asia, north of the parallel of 40°, about the same as in Europe; but in China and Japan it is less considerable than in Europe, *i.e.* nearly the same mean temperature returns after the course of a whole year.

For example, the greatest observed deviation of the mean temperature of August in Peking from the true 23 yearly mean, 24°.6 Celcius, has been only 1°.2 Celcius (2°.2 Fahrenheit); whilst the corresponding value of this quantity, observed in August in Italy (about on the same latitude as Peking) is 2°.8 (5°.0 Fahrenheit) or more than double that of Peking.

The most constant season, in regard to the non-periodic fluctuation of the mean temperature from year to year, is the summer; and the most variable, the winter.

Consequently in China and Japan the normal, periodic changes of the mean temperature, or the periodical contrast between summer and winter, is very great, much greater *e.g.*, than in Europe; but the non-periodic change of the monthly and annual mean temperature from year to year is insignificant, less than in Europe. The same law holds good for the barometric condition and for the other meteorological elements, in Eastern Asia, but not for the moisture; especially not for the summer rains on the continent of Eastern Asia, northerly from the parallel of 33°, in North-China and the Amoor-Territory; where, in consequence of the small intensity of the ascending air current within the Asiatic summer cyclone, or of the small elevation of the land above the sea, or the mildness of the winds, bringing moisture from the sea, or the great distance from the ocean, etc., the rain of the whole summer sometimes scarcely exceeds zero, whilst at other times it is considerable.

Southern China and Southern Japan have every year heavy rains, beginning in spring and ending in autumn, because there then blow winds from the adjacent sea, and these countries are mountainous. According to the charts of isobaric lines and prevailing winds over the globe, constructed by A. Buchan, there appears during April over Northern India and Thibet a central region, where the air, warmed and rarified by insolation from the ascending sun, as it rises higher and higher over the northern hemisphere and heats the dry Asiatic continent, ascends to higher regions, and flows outwards over the fringe of the continent.

Within this central region the atmospheric pressure is a minimum, increasing in all radial directions; and thither the air of the surrounding countries flows or tends to flow.

This central region of elliptical shape gradually advances and extends after April to the N. N. E.; and in July its centre has its most northern position, on the parallel of 40°.

After July its northern extension diminishes and returns to the South; and in October the barometric minimum disappears, and in November there has formed, mainly in consequence of the ingress of the winters cold, a central region of high atmospheric pressure, which is, during November, December, January, February and March situated near Lake Baikal.

During these winter months the wind in Eastern Asia blows uninterruptedly from the cold and dry interior of the continent,

where exists the central region of high atmospheric pressure above described. The relative humidity is low and the air dry. Precipitation, therefore, during these months occurs but seldom on the continent of Eastern Asia, and is frequent only on the islands and some parts of the coast of the continent.

During the warm months April-October the frequency of rain depends, besides the configuration and nature of the surface of the globe under review, which is the very same every year, mainly upon the position and extension of the above-mentioned central region of the summer cyclone; because thither flows or tends to flow the air from the surrounding countries, and its position determines the direction of the winds also in Eastern Asia.

Should eventually, by the comparison of a much greater number of observations than have up to this time been made, the normal position and extension of this central region, as well as the laws governing its metamorphosis and change of position, become exactly known, we shall probably be able to predict, in spring *e.g.*, a certain time in advance the commencement of the summer rains; provided that we should be placed in a position to receive from time to time information on the state of the weather from a number of stations in Eastern Asia.

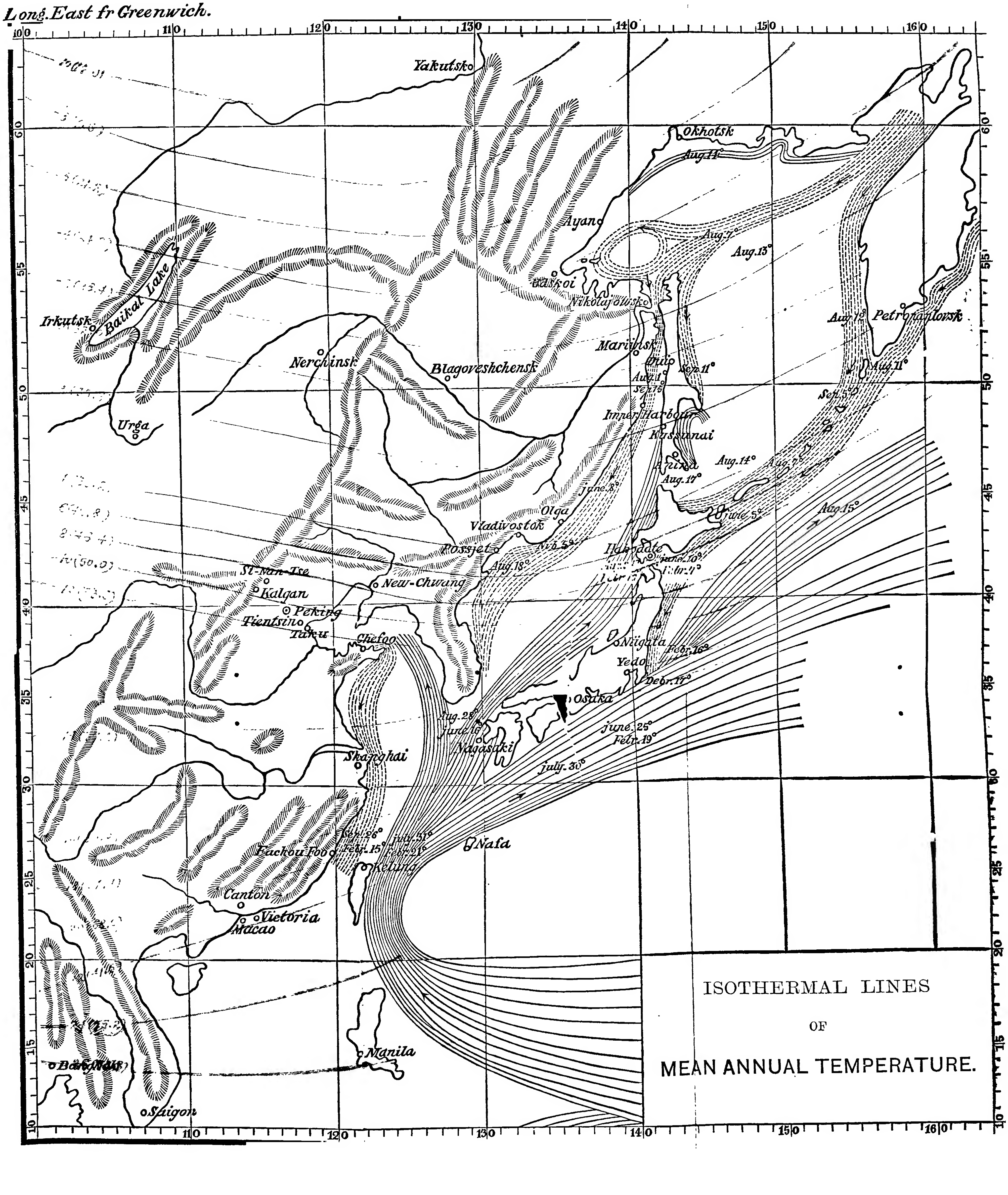
This is a question, especially interesting for the northern part of the continent of Eastern Asia, for Northern China and Amoor-Territory, where, as in the whole of Asia, in each summer, with a very few exceptions, a high temperature favours vegetable life, but when sometimes the equally necessary summer rains, though eagerly expected, fail to appear.

ERRATA AND CORRIGENDA

In Article II.

Page 24	No.	34	for *chüeh*^{4} ....read *ch'üeh*^{4}.
" 25	"	68	" *t'ou* .... " *t'ou*^{1}.
" 26	"	70	" *kuo*^{1} .... " *kou*^{1}.
" 26	"	79	read an empty bottle.
" 27	"	106	for *Mo*^{2} ....read *Mi*^{2}.
" 27	"	127	" *Piao*^{4} .... " *P'iao*^{4}.
" 28	"	163	" *Tou*^{1} .... " *Tou*^{4}.
" 29	"	185	add, see *I*^{4}.
" 31	Line	6	for on to ....read out.
" 31	"	17	" *p'ei*, ... " *pit*,.
" 31	No.	10	" ꜀*Ch'am* .... " ꜀*Ts'am*.
" 32	"	25	" ʿ*Ch'eng* .... " ꜀*Ch'eng*.
" 32	"	55	" ꜂*K'ai* .... " ʿ*K'ái*.
" 32	"	56	" *Kák*$_o$ (*bis*) ...... " *Kat*$_2$.
" 33	"	57	" ꜂*p'a* .... " ꜀*p'á*.
" 33	"	61	" ʿ*K'án* .... " ʿ*Kán*.
" 33	"	71	" *Kip*$_o$ .... " *Kip*,.
" 33	"	76	" ꜀*p'áu* .... " ꜀*p'ái*.
" 33	"	79	" ꜀*lù* .... " *lù*^{2}.
" 33	"	80	" ʿ*shan* .... " ʿ*shau*.
" 33	"	87	" ʿ*Kwái* .... " ʿ*Kwai*.
" 33	"	90	" ꜀*Kwé* (*bis*) ...... " ꜀*Kwei*.
" 34	"	106	" *id.* .... " *id.*
" 34	"	113	insert ꜀*m'* between ꜀*yan* and ꜀*lú*.
" 34	"	114	for ꜀*Lù* (꜀*lö*) ....read *Lo'*, local *lö'*.
" 34	"	115	" ꜀*lù* .... " *lù*^{2}.
" 34	"	118	" ꜂*ma* .... " ꜂*má*.
" 34	"	122	" ʿ*Mang* ʿ*k'ang* ... " ꜀*Mang* ꜀*k'ang*.
" 34	"	130	" *lì'* .... " *lì*^{2}.
" 35	"	148	*dele a.*
" 35	"	151	for ꜀*ping* ....read ꜀*p'ing*.
" 35	"	160	" ꜂*Un suk*$_2$ *suk*$_2$ ... " ꜂*un shuk*$_2$ *'huk*$_2$.
" 36	"	181	" ʿ*To* (*bis*)......... " *To*^{2}.
" 36	"	183	" ꜂*T'o* (*bis*) ...... " ꜀*T'o*.
" 36	"	186	" ʿ*han* .... " ʿ*hau*.
" 36	"	204	꜀*Yeong* is 文 not colloquial.
" 37	"	3	*dele.*
" 37	"	5, 6 and 7	*dele.*

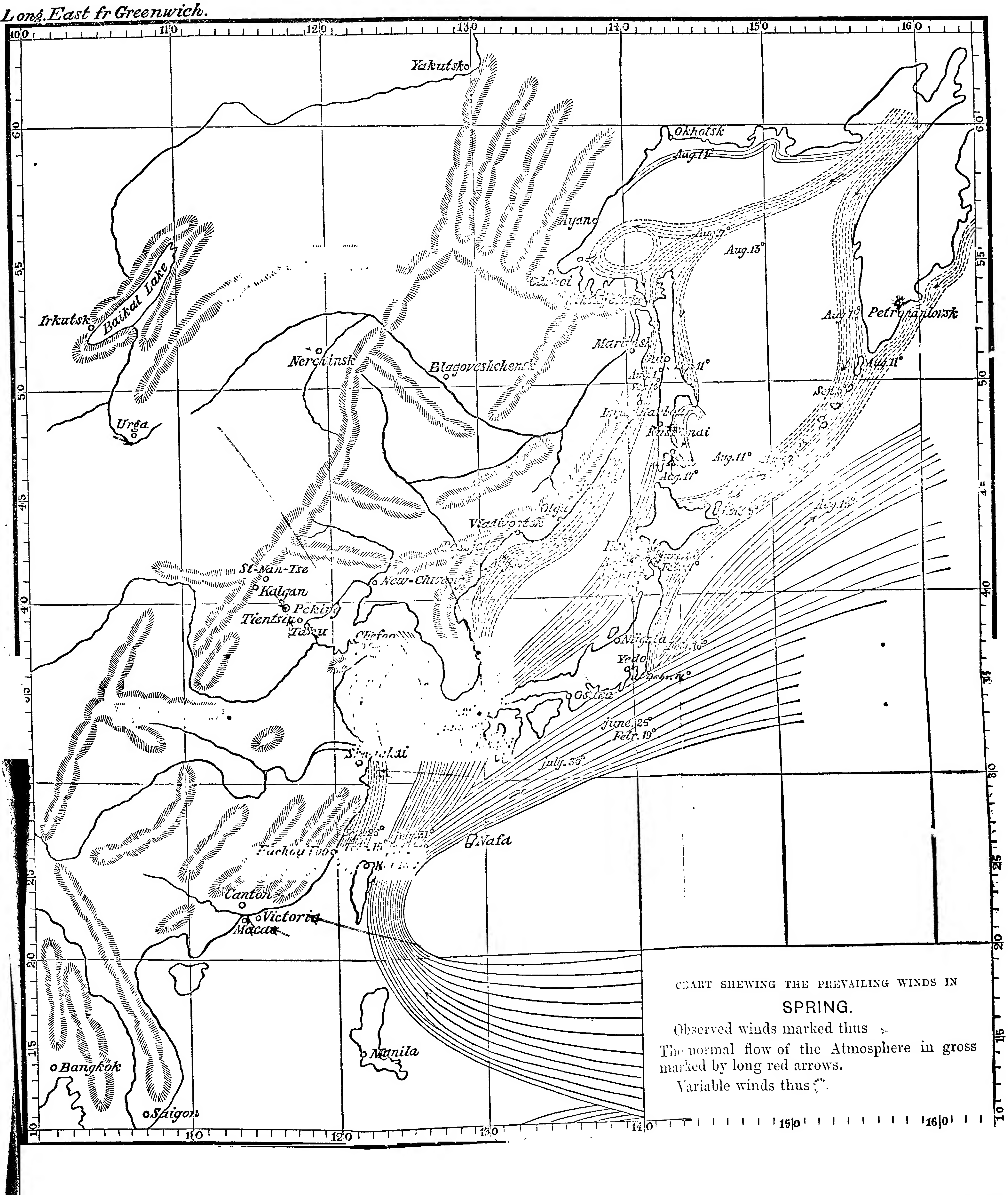
Page 37—No.	13	*dele* Same as *chwok*,	
„ 37 „	21	add, perfunctory, loose, slovenly.	
„ 38 „	24	for shably ....read	shabby.
„ 38 „	29	„ *꜀êng*............... „	*mek꜁*.
„ 38 „	31	„ *꜀kë* (*bis*) .... „	*këh꜁*.
„ 38 „	31	„ *ma²* .... „	*má²*.
„ 38 „	44	„ *Sa'* .... „	*'Sieu*.
„ 38 „	49	should read *Liah꜁*; (the same as *sioh꜁ chiah꜁* "one piece."	
„ 38 „	51	should read "it will be long yet."	
„ 38 „	53	for *ch'ien'*............read	*ch'ieu'*.
„ 39 „	64	„ *꜀chiang* .... „	*'chiang*.
„ 39 „	70	read *꜀neng ꜀pwo*, the breast (of a man.)	
„ 39 „	78	for "soar" ....read	"swoop."
„ 39 „	85	*dele*.	
„ 41 „	1	for *Ch'a²* .... „	*Ch'a³*.
„ 41 „	3	„ *Ts'at'* .... „	*Ts'at꜁*.
„ 43 „	27	„ *Lê⁵-lê⁵* .... „	*Tê⁵-lê⁵*
„ 43 „	32	*dele Wo꜅*.	
„ 46 „	25	for 平 .... „	上.
„ 48 „	12	*dele* ei (*bis*.)	



ISOTHERMAL LINES OF MEAN ANNUAL TEMPERATURE.

Cold currents of water.
Warm currents of water.
→ Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
What belongs to the phenomena within the atmosphere, is in this chart red, what belongs to land and water, black.
The Temperatures within brackets are in Fahrenheit Scale; the other Temperatures in Centigrade Scale.



Cold currents of water.
Warm currents of water.
Direction of the currents of water.

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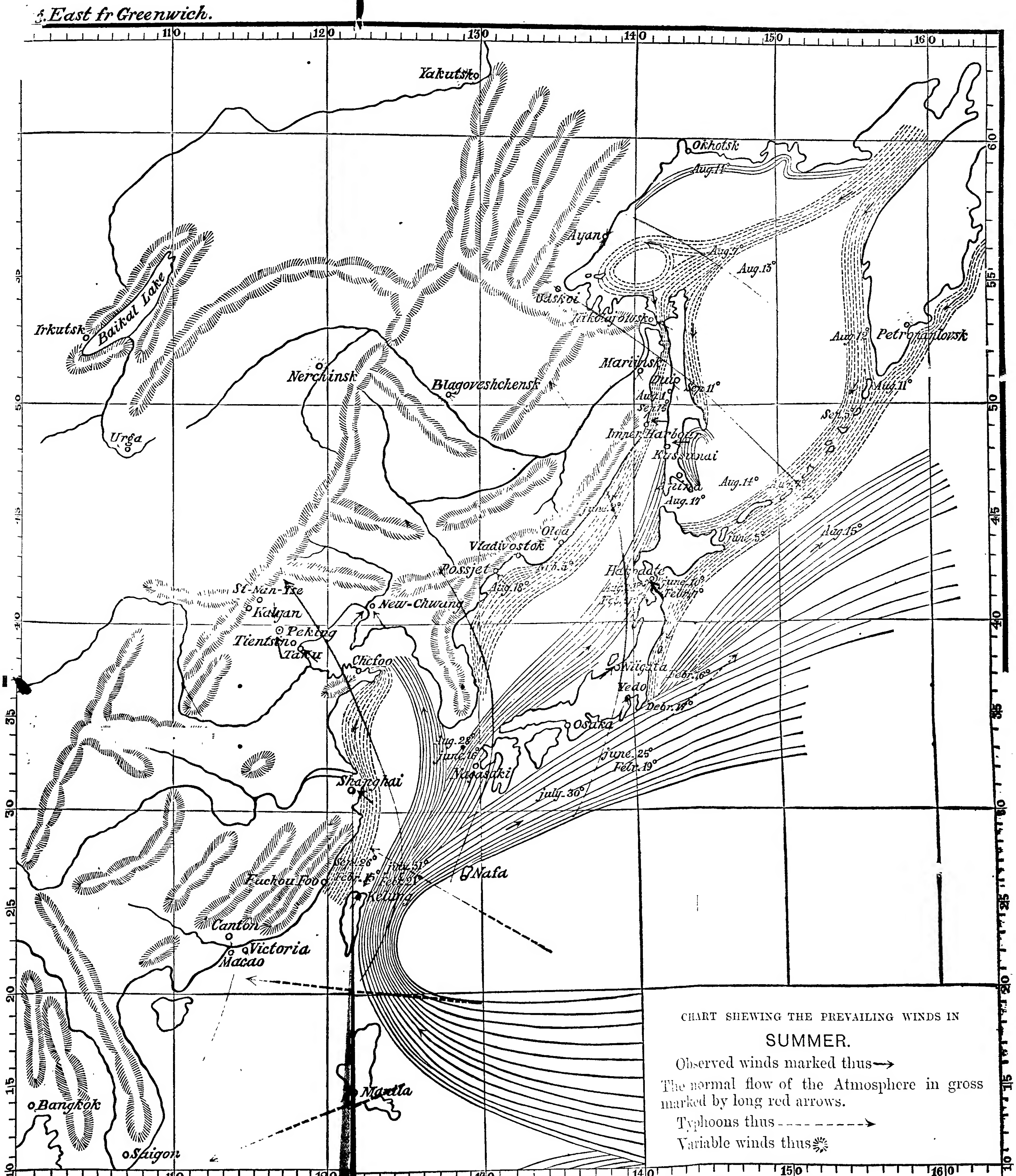

Cold currents of water.
Warm currents of water.
Direction of the currents of water.

The numbers within the … rents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this te… erature occurs.
What belongs to the phe… ena within the atmosphere, is in this chart *red*, what belongs to land and water, *black*.
The Temperatures withi… rackets are in Fahrenheit Scale; the other Temperatures in Centigrade Scale.

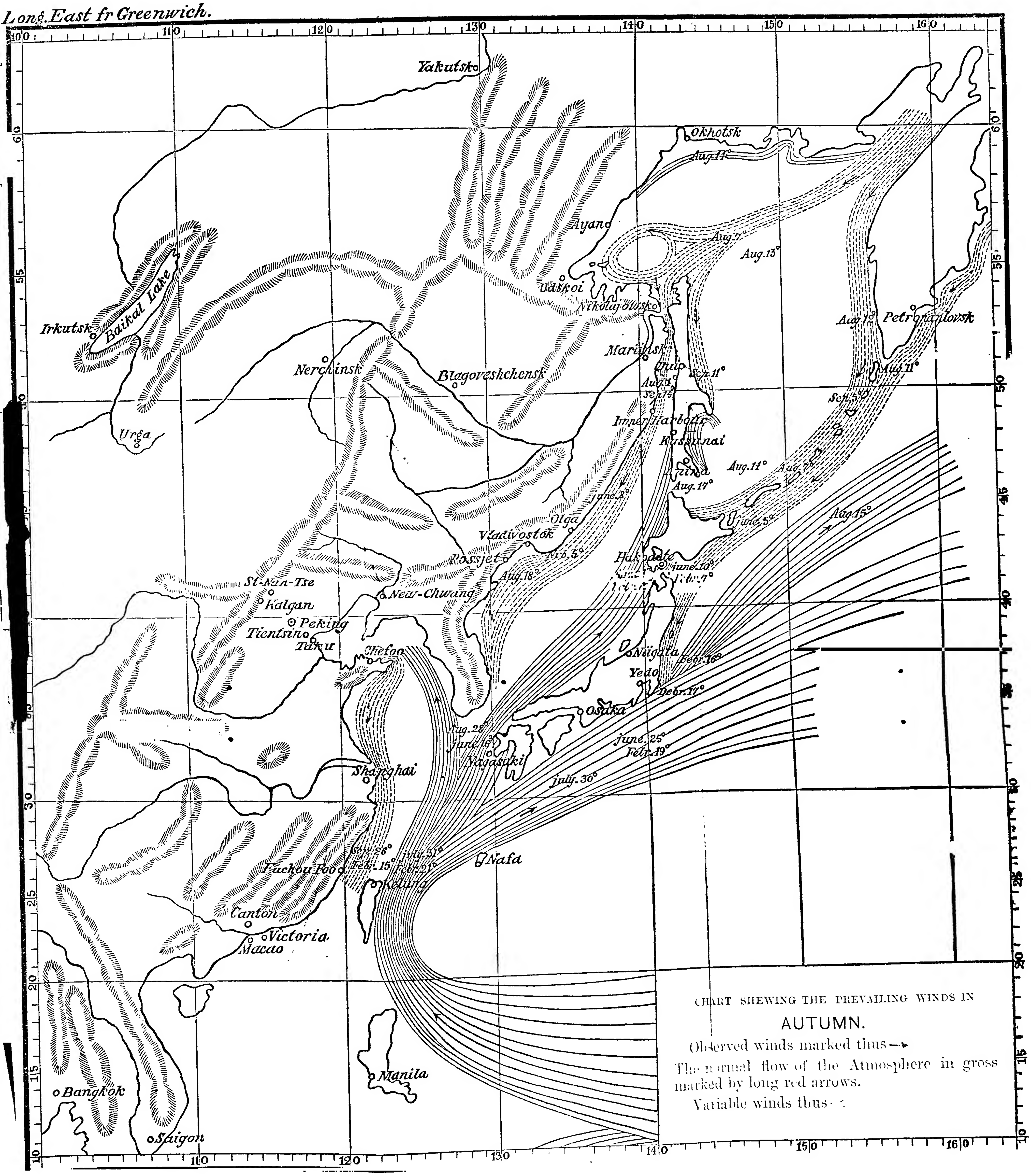

CHART SHEWING THE PREVAILING WINDS IN

AUTUMN.

Observed winds marked thus →

The normal flow of the Atmosphere in gross marked by long red arrows.

Variable winds thus ⇢

Cold currents of water.
Warm currents of water
→ Direction of the currents of water.

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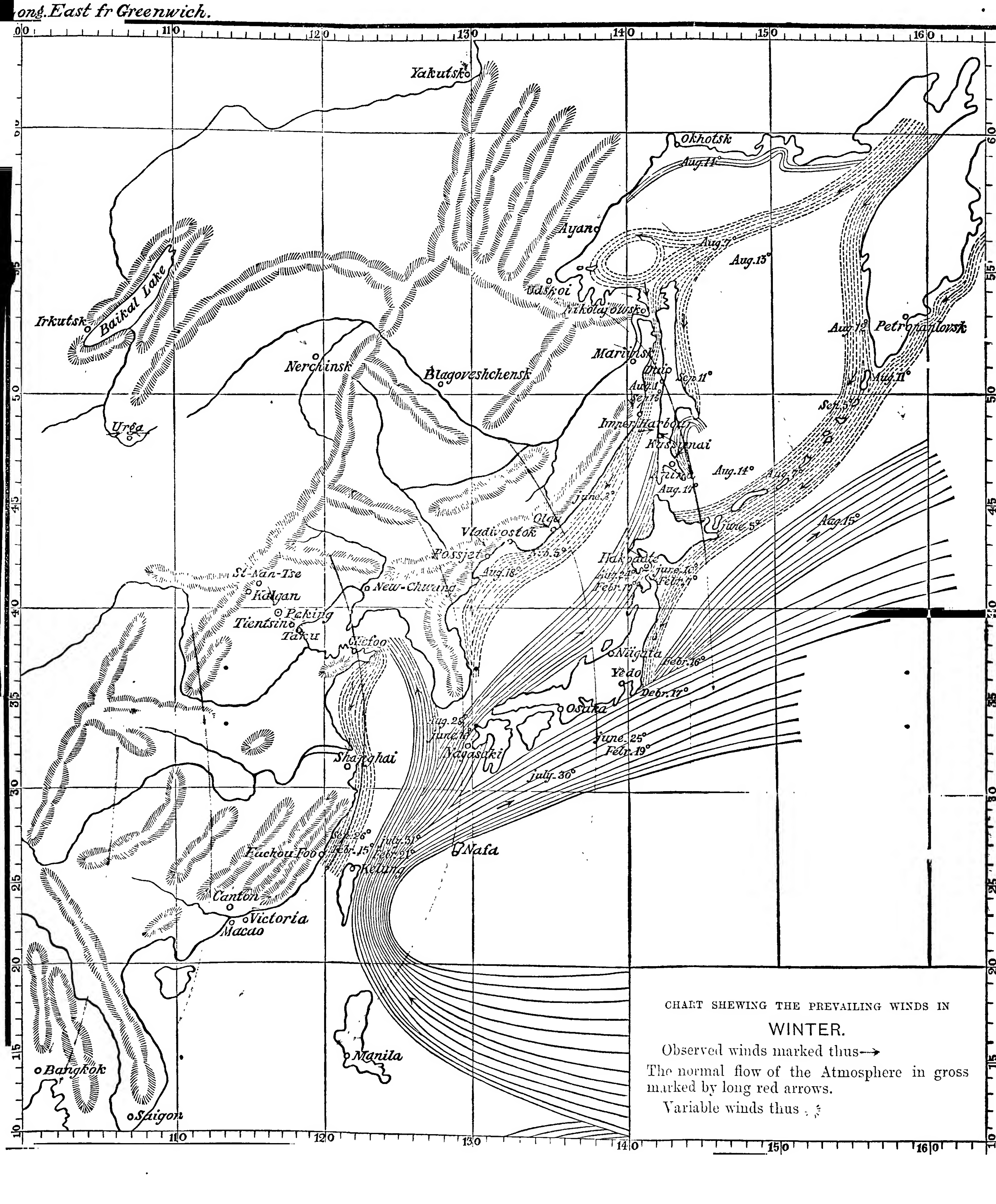

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
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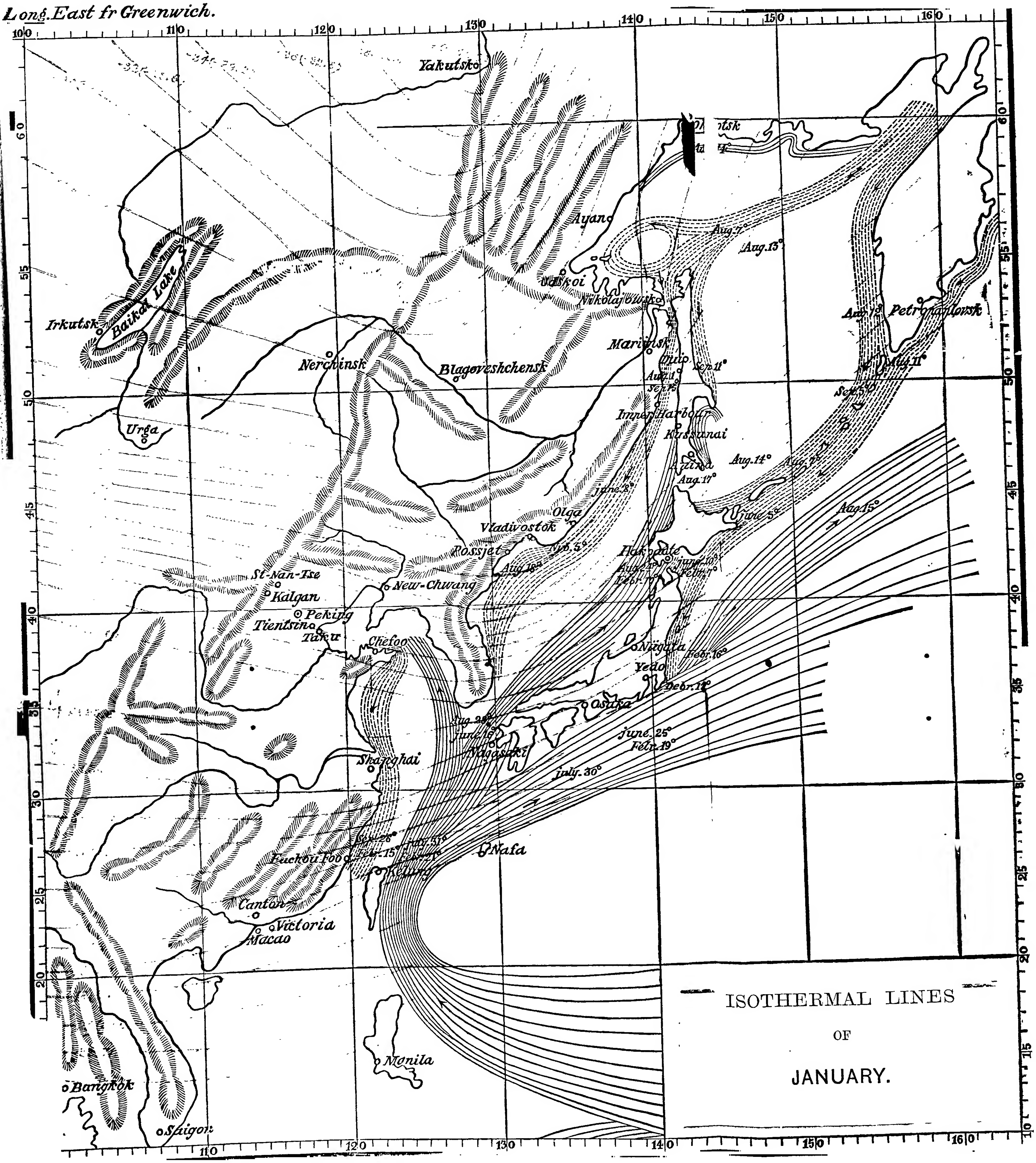


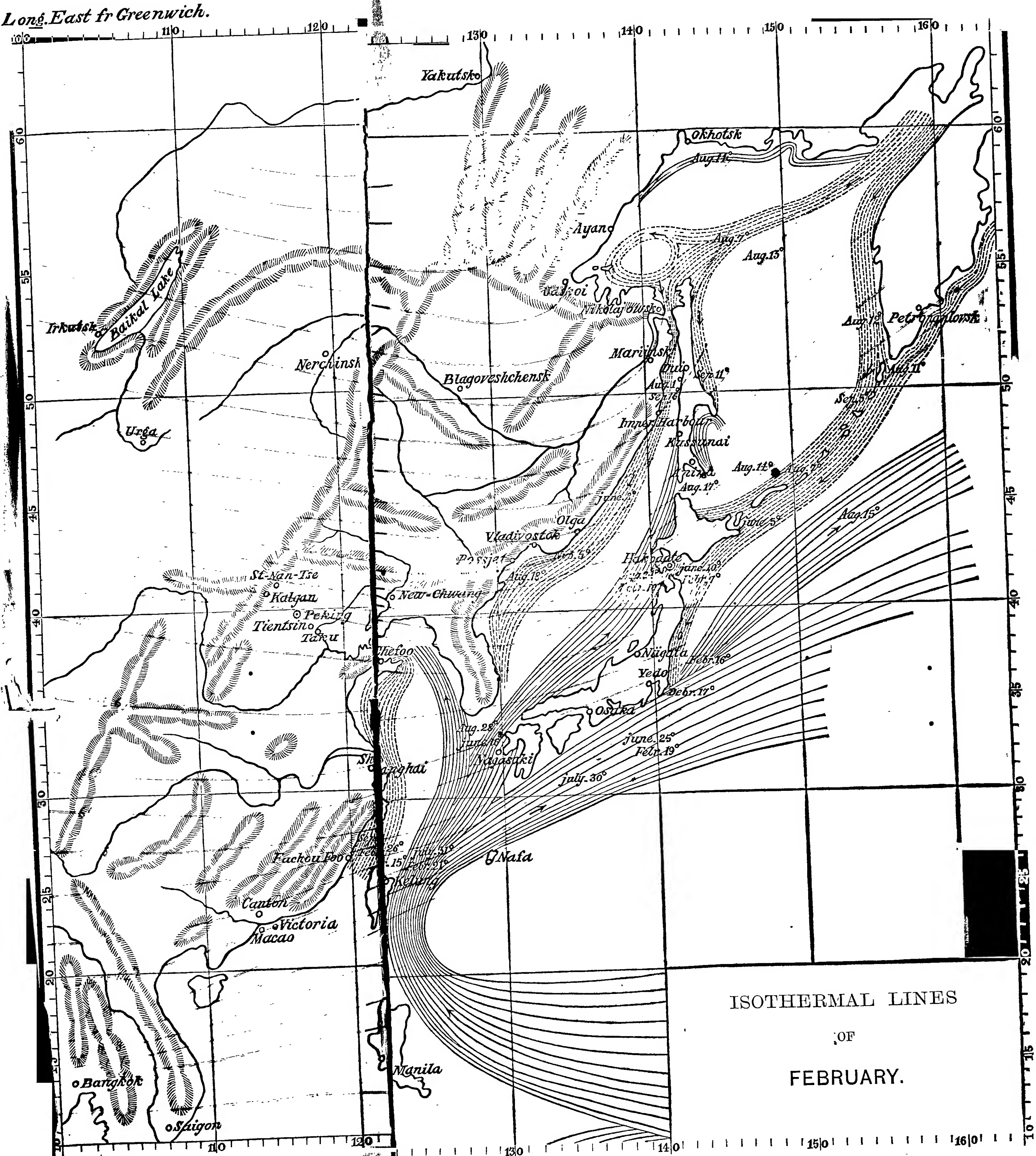
ISOTHERMAL LINES OF JANUARY.

- Cold currents of water.
- Warm currents of water.
- Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.

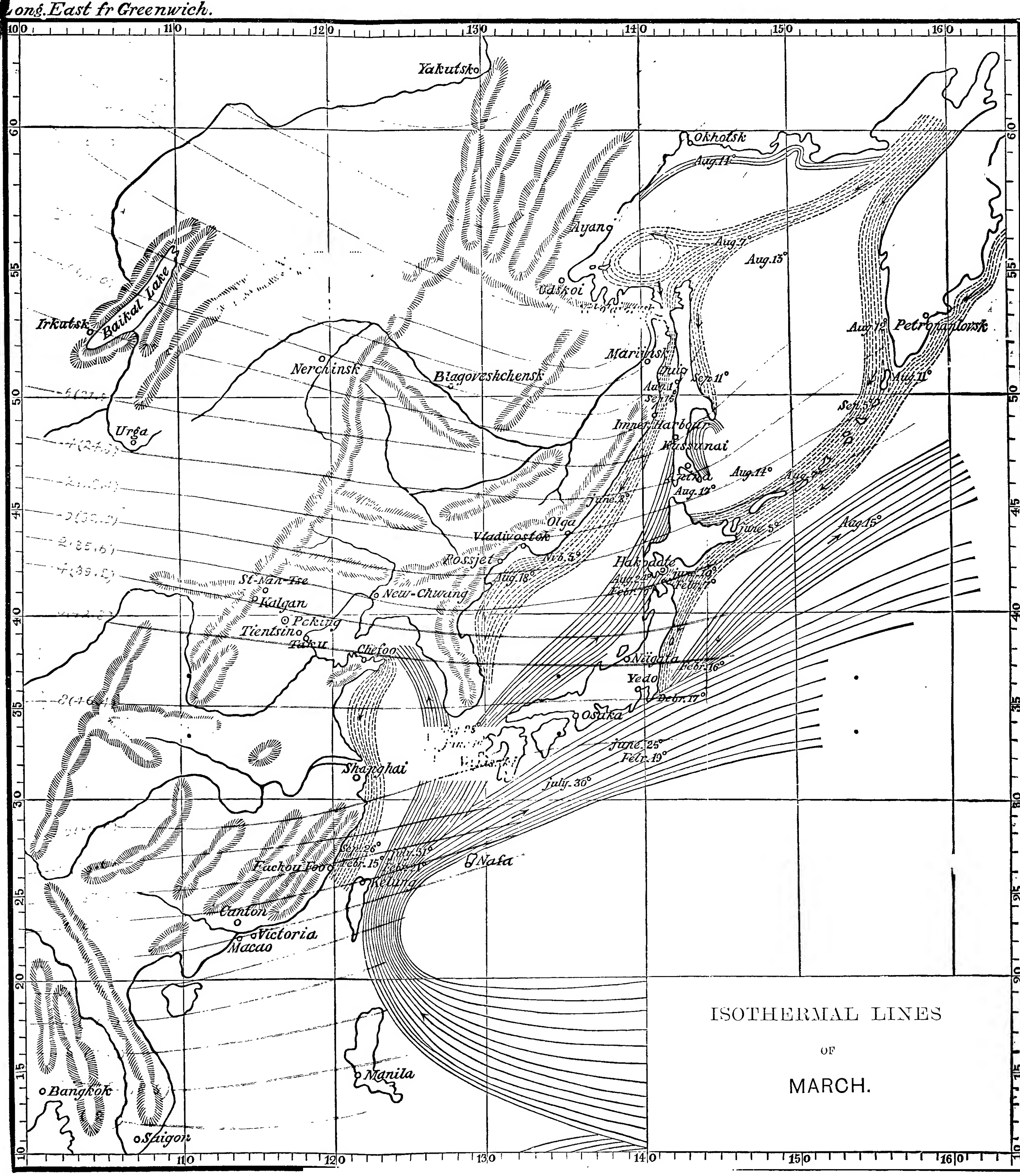
What belongs to the phenomena within the atmosphere, is in this chart *red*, what belongs to land and water, *black*.

The Temperatures within brackets are in Fahrenheit Scale; the other Temperatures in Centigrade Scale.



ISOTHERMAL LINES OF FEBRUARY.

The numbers within t... months when this ...ents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this ... What belongs to the p...ature occurs.
The Temperatures wit...na within the atmosphere, is in this chart *red*, what belongs to land and water, *black*. ...ckets are in Fahrenheit Scale; the other Temperatures in Centigrade Scale.



Cold currents of water.
Warm currents of water.
Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the name of "January, February, May, June, July, August, September," signify the months when this temperature occurs.
What belongs to the phenomena within the atmosphere, is in this chart *red*, what belongs to land and water, *black*.
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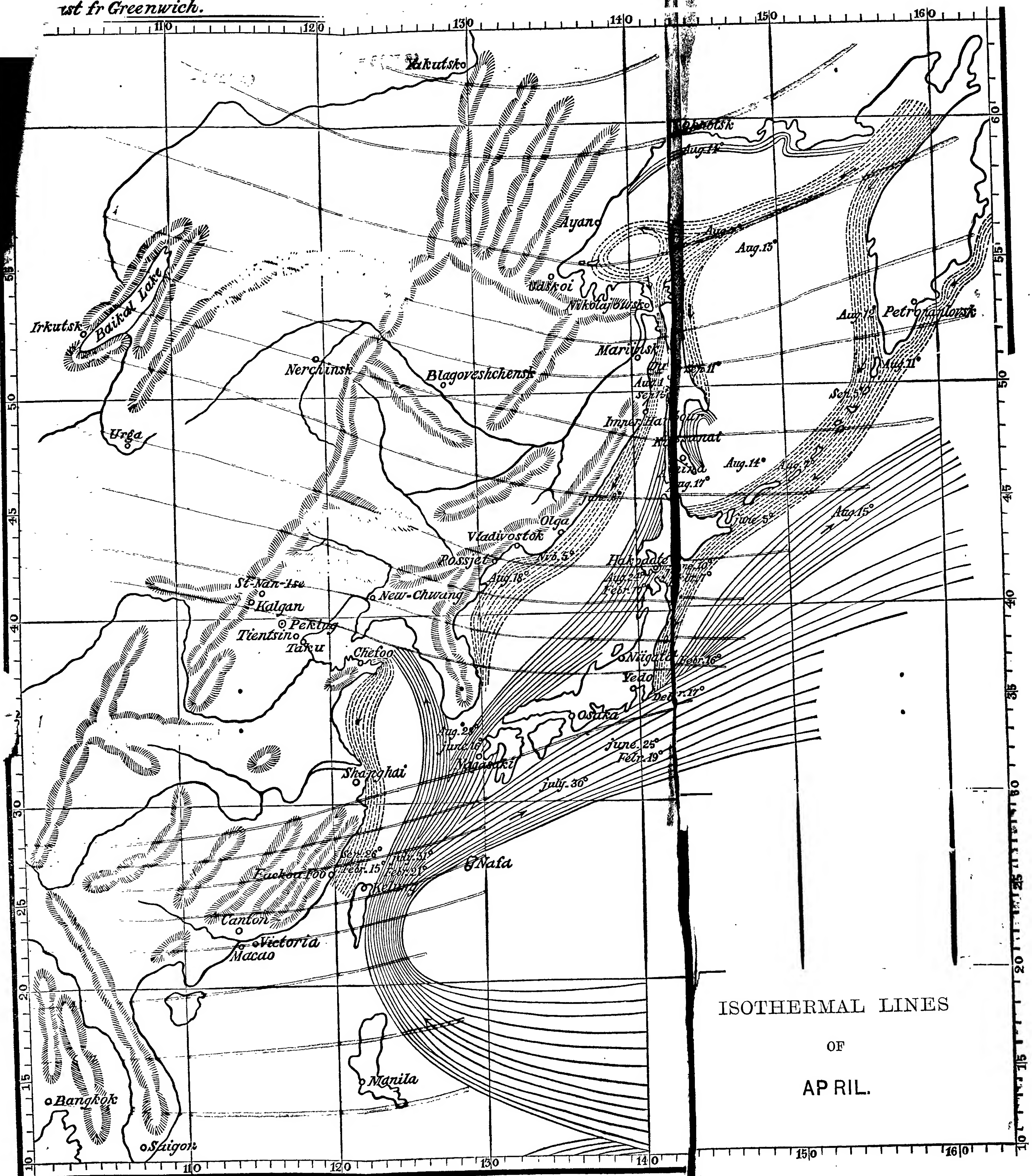

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Warm currents of water.
Direction of the currents of water.

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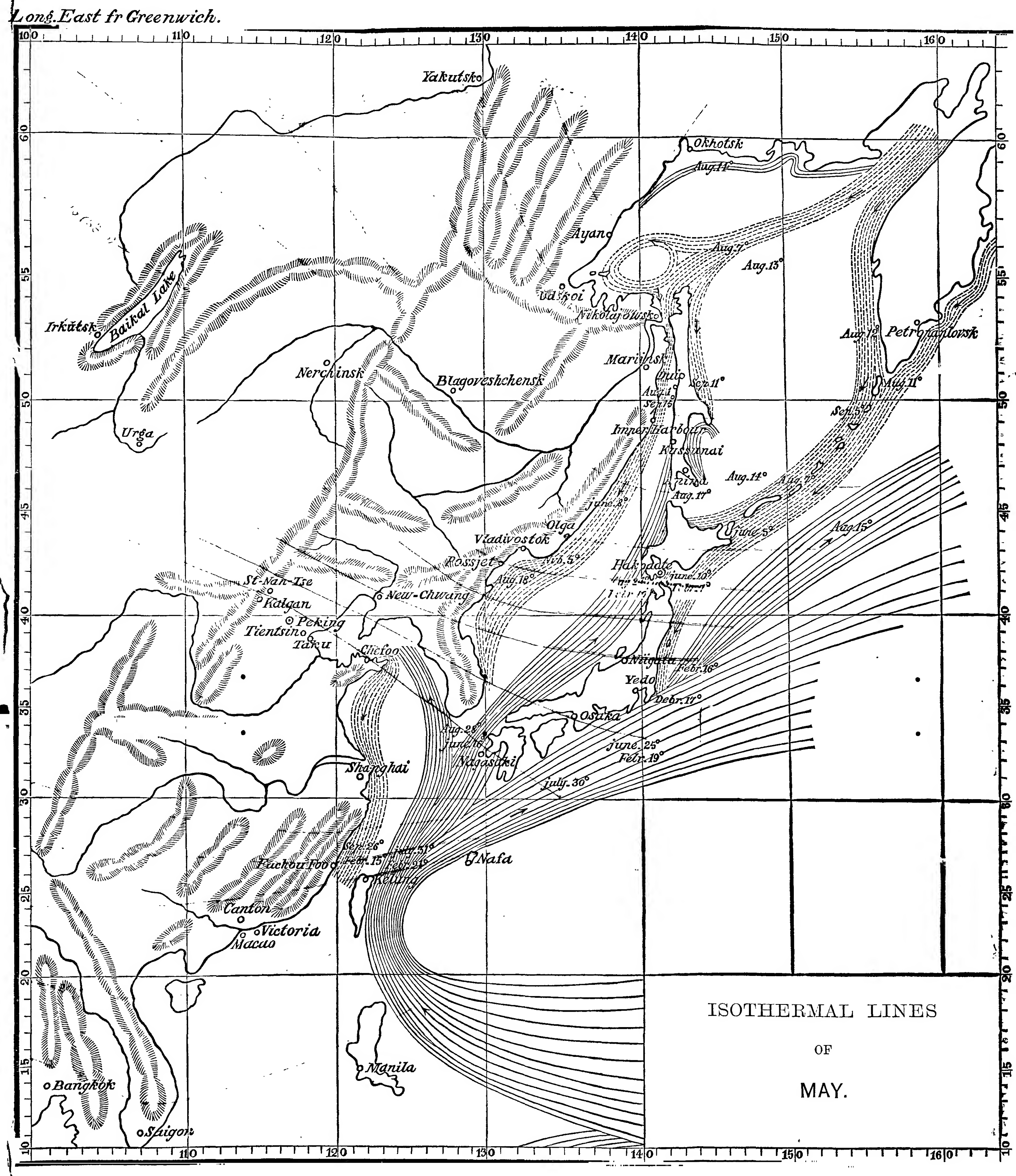

Cold currents of water.
Warm currents of water.
Direction of the currents of water.

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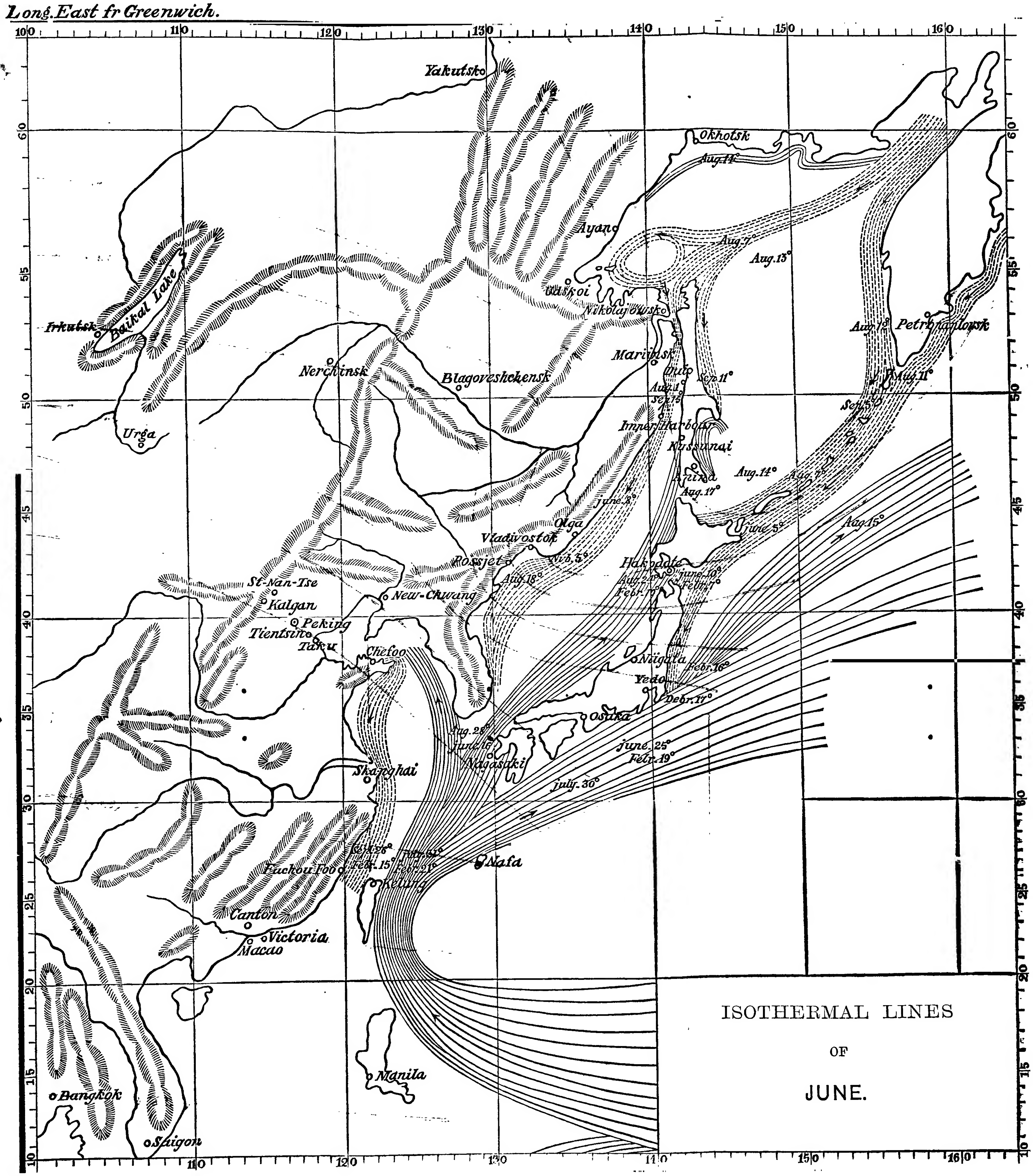

ISOTHERMAL LINES OF JUNE.

Cold currents of water.
Warm currents of water.
Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.

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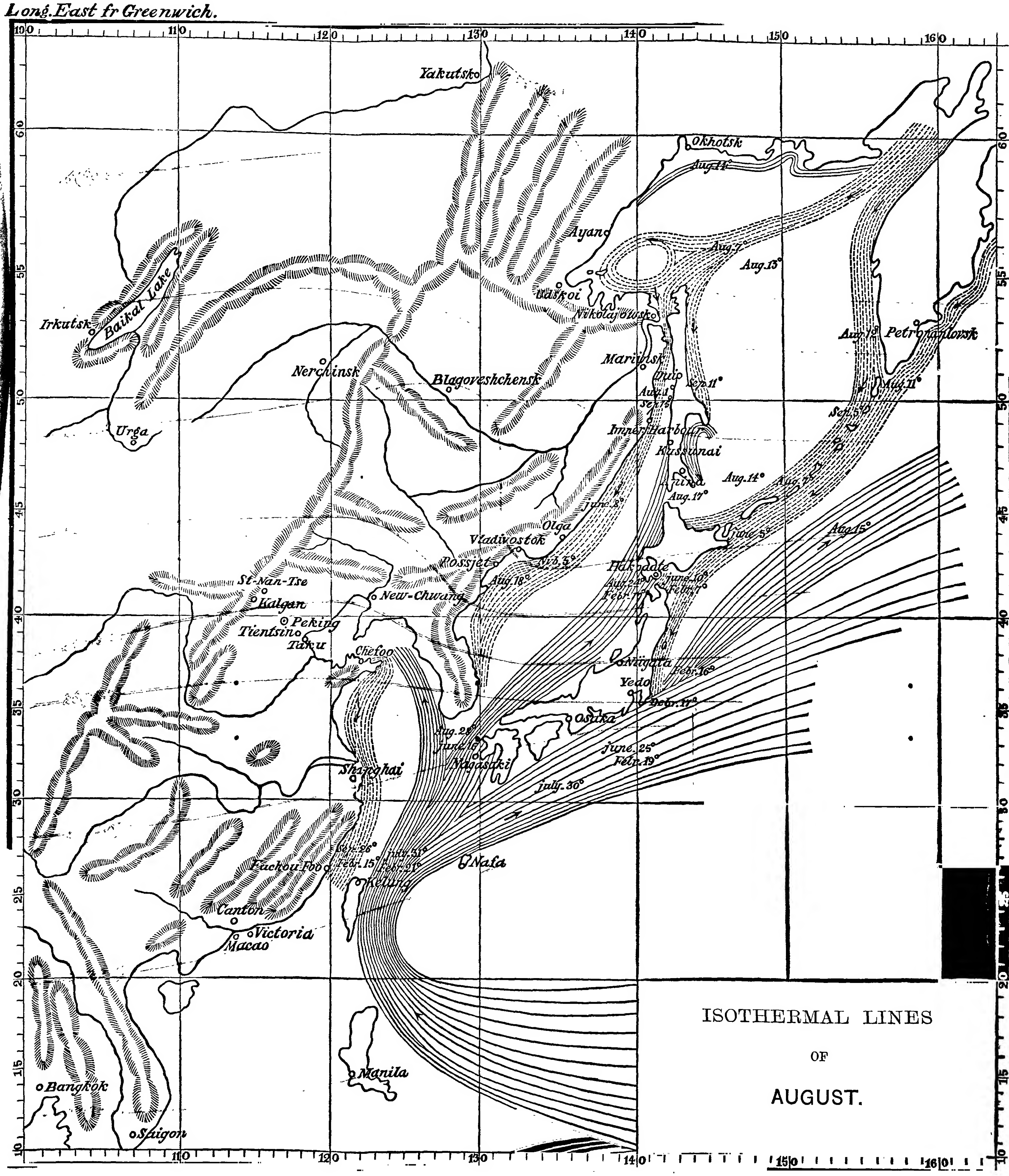

ISOTHERMAL LINES OF AUGUST.

Cold currents of water.
Warm currents of water.
Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
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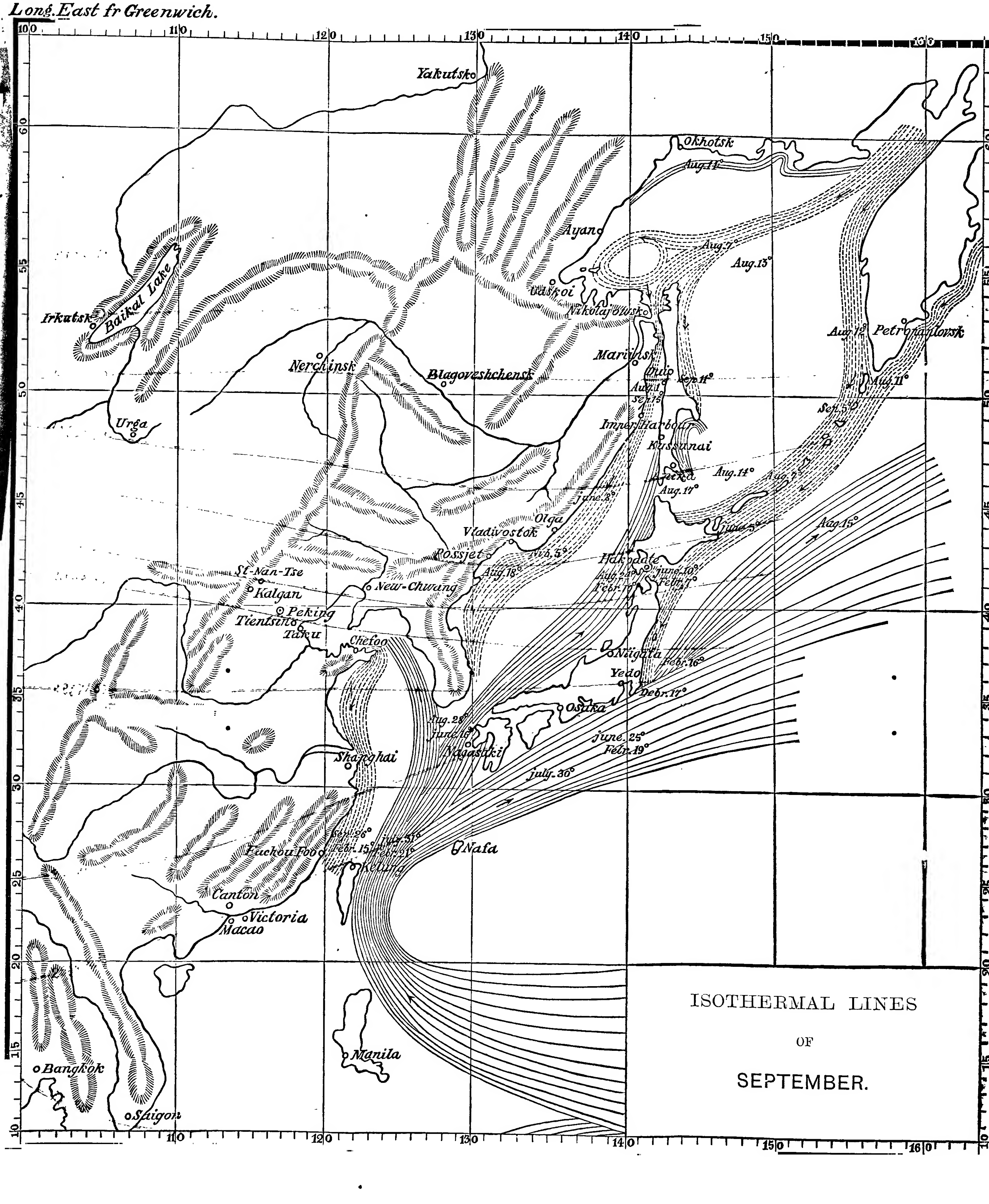

ISOTHERMAL LINES OF SEPTEMBER.

Cold currents of water
Warm currents of water.
→ Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
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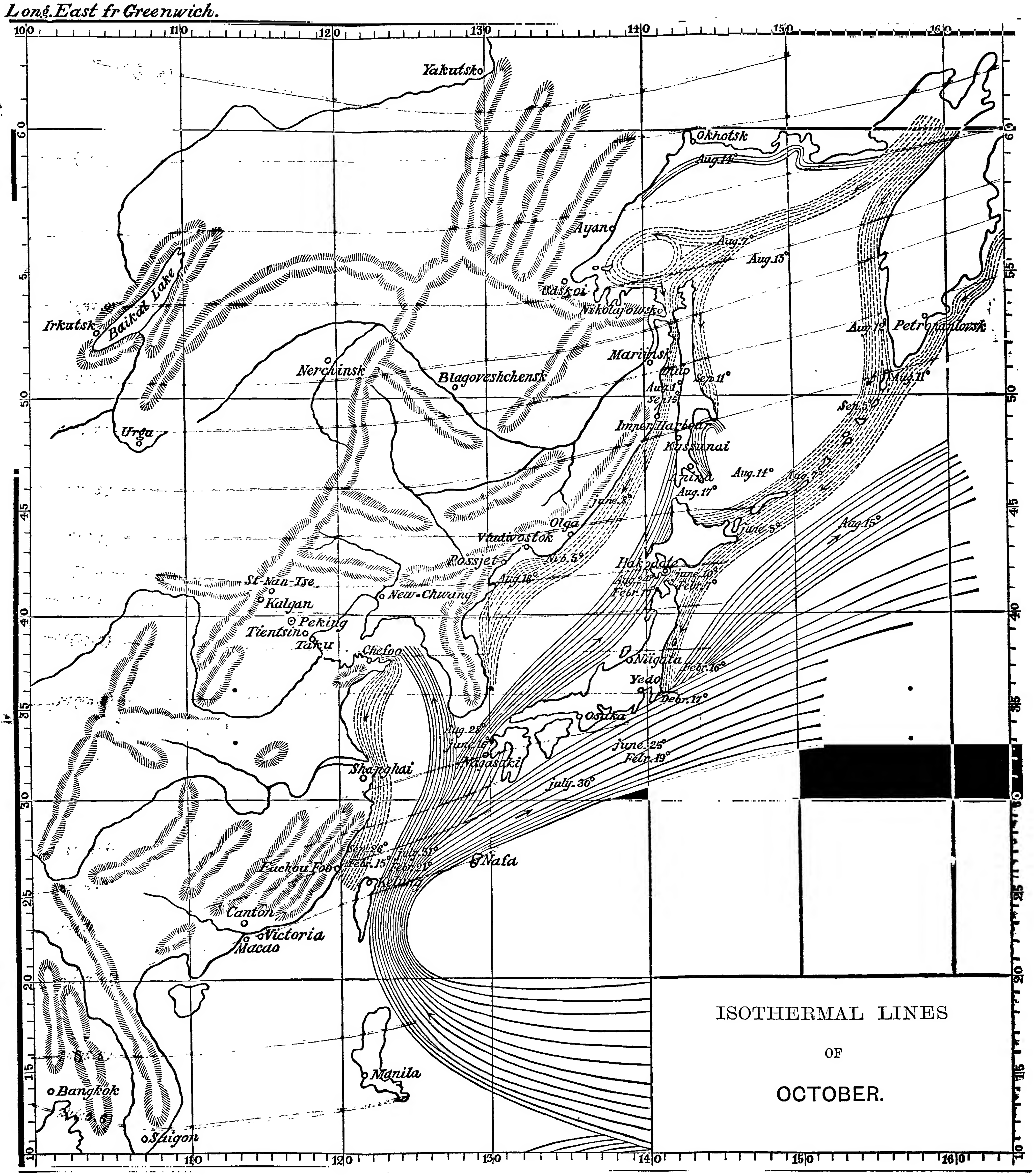

Cold currents of water
Warm currents of water.
Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
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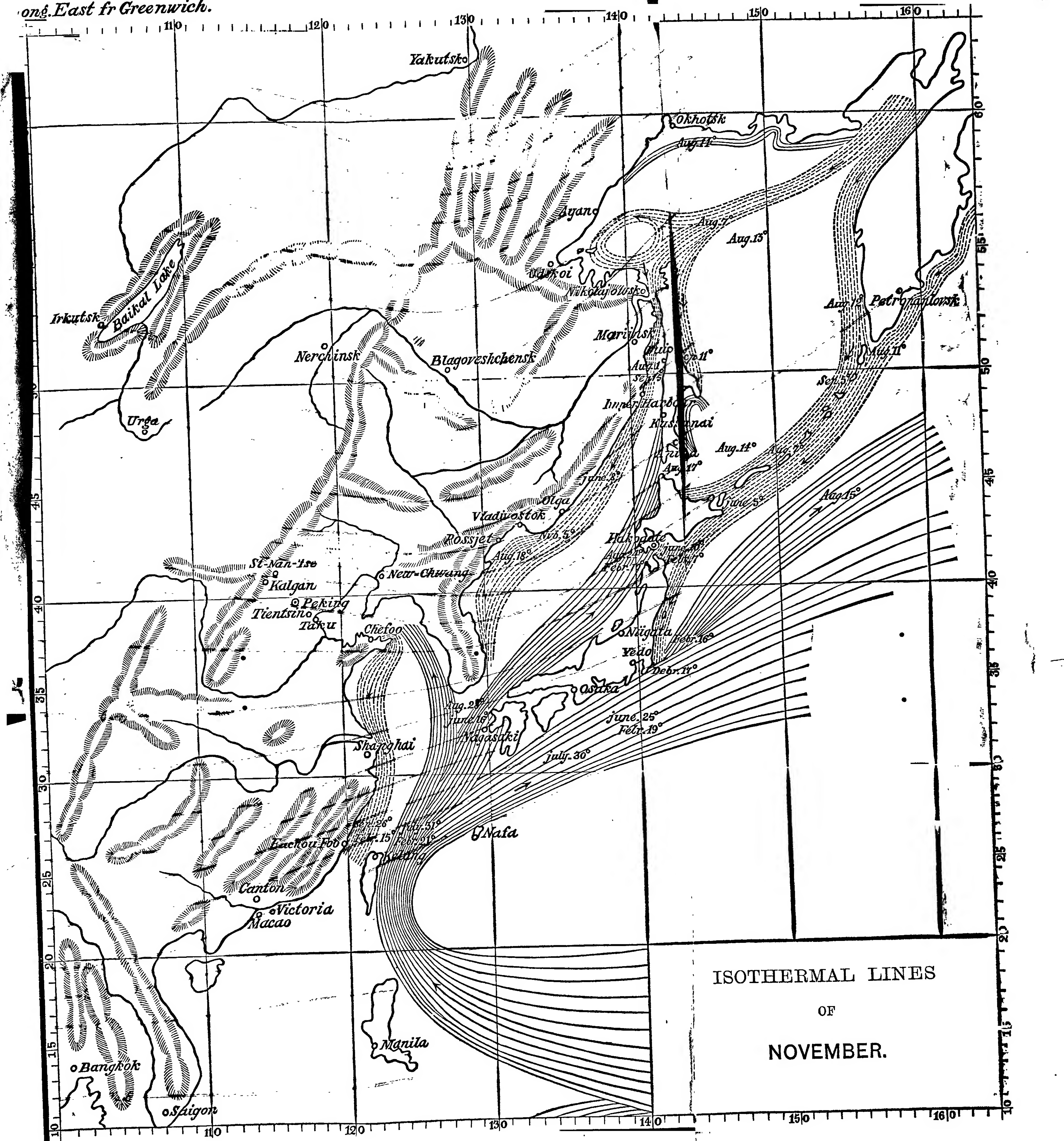

- Cold currents of water.
Warm currents of water.
→ Direction of the currents of water.

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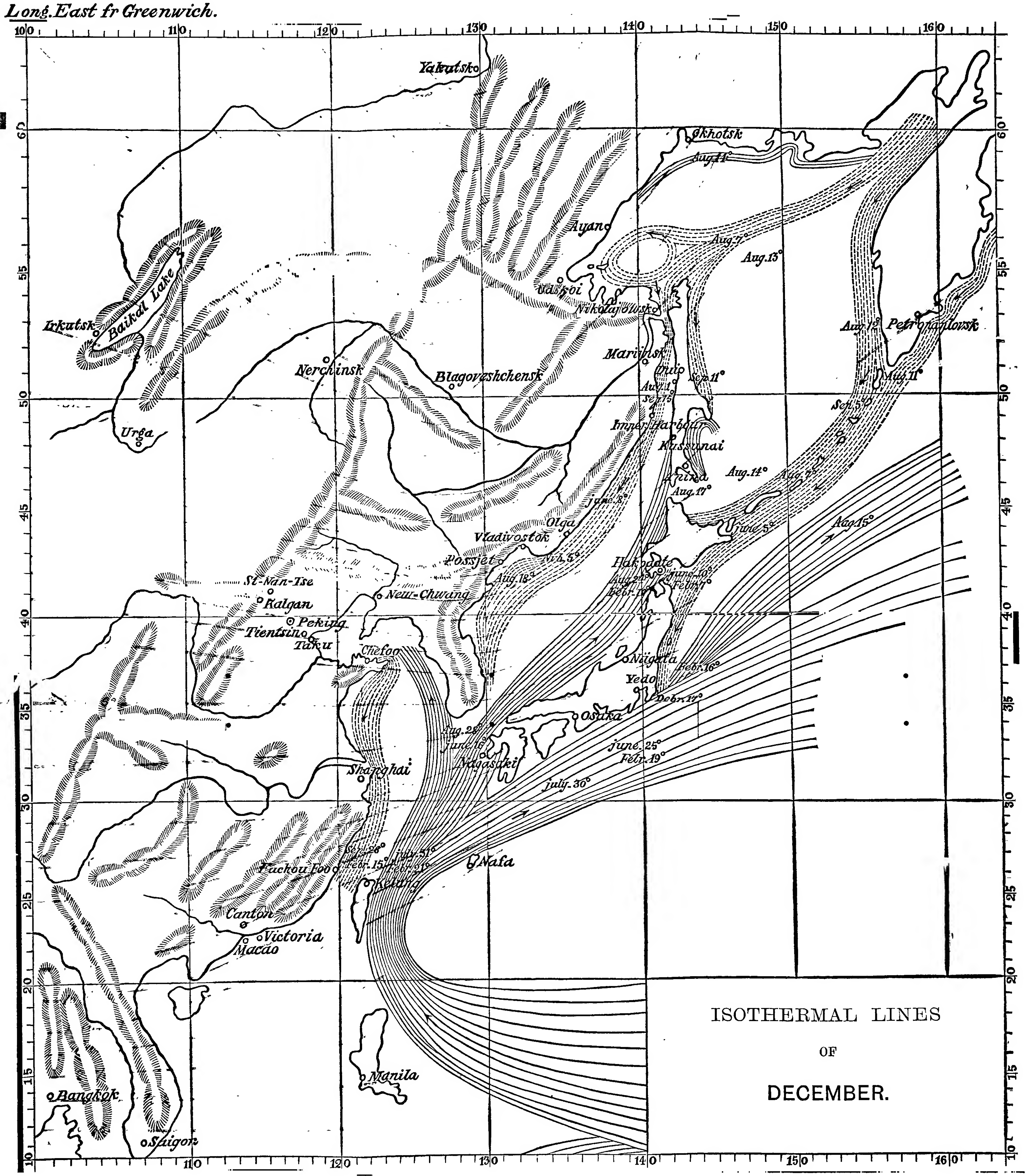

ISOTHERMAL LINES

OF

DECEMBER.

Cold currents of water.
Warm currents of water.
→ Direction of the currents of water.

The numbers within the currents signify the temperature of its surface water, and the names "January, February, May, June July, August, September," signify the months when this temperature occurs.
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JOURNAL

OF THE

NORTH-CHINA BRANCH

OF THE

ROYAL ASIATIC SOCIETY.

NEW SERIES, No. XIII.

SHANGHAI:

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1879.

CONTENTS.

REPORT

OF THE

COUNCIL OF THE NORTH-CHINA BRANCH

OF THE

Royal Asiatic Society,

FOR THE YEAR 1878.

AT the Annual Meeting held in January the following gentlemen have been elected Office Bearers for the year 1878, viz :—

T. W. KINGSMILL, Esq., *President.*
F. B. FORBES, Esq.
E. C. TAINTOR, Esq., } *Vice-Presidents.*
JOSEPH HAAS, Esq., *Secretary and Treasurer.*
P. G. VON MÖLLENDORFF, Esq., *Librarian.*
A. FAUVEL, Esq., *Curator.*
C. T. GARDNER, Esq.,
F. B. JOHNSON, Esq.,
A. KRAUS, Esq.,
D. J. MACGOWAN, Esq., M.D.,
J. E. REDING, Esq.,
T. G. SMITH, Esq., } *Councillors.*

During the year five Meetings have been held, when the following Papers were read :—

1.—"The Political and Commercial Intercourse of China with Central Asia, during the second Century, B. C.,"—by T. W. Kingsmill, Esq.

2.—"The Climatology of Eastern Asia,"—by Dr. H. Fritsche.

3.—"The Toming, an enthralled class of Chekiang,"—by D. J. Macgowan, Esq., M.D.

4.—"Droughts in China, A. D. 620-1643,"—by Alex. Hosie, Esq., M.A.

5.—"On the Stone Figures at Chinese Tombs and the Offering of Living Sacrifices,"—by W. F. Mayers, Esq.

6.—"The Ancient Language and Cult of the Chows, being Notes, Critical and Exegetical, on the Shih-king, or Classic of Poetry of the Chinese,"—by T. W. Kingsmill, Esq.

7.—The Comparative Study of Chinese Dialects,"—by E. H. Parker, Esq.

8.—"Sun-spots and Sun-shadows observed in China, B. C. 28—A. D. 1817,"—by Alex. Hosie, Esq., M. A.

9.—"The Fixing of some of the most Prominent Localities of Shanghai by Triangulation,"—by Lieut. G. Kreitner.

10.—"Periodical Change of Terrestrial Magnetism,"—by F. W. Schulze, Esq.

11.—"Supplementary Notes on the Periodicity of Famines in China and their connexion with Sun-spots,"—by Alex. Hosie, Esq., M.A.

12.—"Rock Inscription at the Northside of Yentai Hill,"—by J. Rhein, Esq.

13.—"The Family Law of the Chinese and its Comparative Relations with that of other nations,"—by Herrn P. G. von Mollendorff.

14.—"The Origin of Greek Names for China and the Chinese,"—by T. W. Kingsmill, Esq.

15.—"On the Alligators of China,"—by A. Fauvel, Esq.

In the course of the year twenty-five new members have been elected, while ten gentlemen resigned their membership. There is also to be recorded the sad loss by death of three valuable members in the persons of Messrs. E. C. Taintor, W. F. Mayers and F. E. Heyden, the two former having for a number of years been some of our most prominent and accomplished contributors.

Owing to difficulties which to overcome were beyond the control of the Editorial Committee, the publication of the Society's Journal has been unfortunately very much retarded, however its publication will very shortly appear.

A List of the Members is herewith appended.

Subjoined are the Treasurer's, the Librarian's and the Curator's Reports.

LIST OF MEMBERS.

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Sir Brooke Robertson, C.B.
Vice-Admiral Sir Charles Shadwell, K.C.B.
Sir T. F. Wade, K.C.B.
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Geo. F. Seward, Esq.
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H. Bailey.
J. de Bielke.
J. D. Bishop.
Chevalier C. de Boleslawski.
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Very Rev. Dean Butcher, D.D.
B. Christiernson, M.A.
J. M. Cory.
J. D. Crawford.
A. Davenport.
A. Fauvel.
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Herbert Allen—Wuhu.
W. S. Ayrton—Hankow.
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C. D. Braysher—Newchwang
Byron Brenan—Peking.
H. B. Bristow—Chinkiang.
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J. Dodd—Amoy.
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E. Farago—Chefoo.
His Ex. J. H. Ferguson—Chefoo.
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F. Kleinwachter—Amoy.
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Rev. G. S. Owen—Peking.
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J. Rhein—Chefoo
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T. Sampson—Canton.
Lieut. C. A. Schultz—H'kong.
His Ex. C. A. Skatschkoff—St. Petersburg.
Hon. Cecil C. Smith—S'pore.
Reginald D. Starkey.
G. C. Stent—England.
C. C. Stuhlmann—Hoihow.
S. A. Viguier—Newchwang.
T. Watters—Ichang.
F. W. White—Hankow.
H. Wicking—Hongkong.
R. Chatterton Wilcox—H'kong.

TREASURER'S REPORT.

To the Committee of the

North-China Branch of the Royal Asiatic Society,

Shanghai.

Gentlemen,

In laying the Accounts of the North-China Branch of the Royal Asiatic Society before you, I regret to say that the same show a deficit of $107.64.

This however is not so discouraging as one might be inclined to think, looking at it superficially.

It is true that in comparison with last year's there is a great falling out in the proceeds from the sale of the Society's Journal, but this deficiency is to be accounted for, firstly by not having up to this date received the accounts of the booksellers for the last quarter, the proceeds of which will therefore appear in the new year's account; secondly the retard in the publication of last year's Journal, by which the sale was restricted to the former Journals, and thirdly our very liberal free contribution of the same.

On the other hand I am extremely glad to announce that the subscriptions collected in 1878 represent the goodly sum of $859.50, the highest figure ever reached in this item. Taking in consideration the movements of the resident members, the shifting about of the non-resident ones, this amount is highly creditable to our Society, as it shows the interest China residents take in the wellfare and progress of our Society. This is our chief income upon which our Society depends, with which we defray the numerous expenses, and which helps us to carry on the scheme the Society ever had in view, namely propagation of science in China, and supply means to study the country and people, among whom we live and of whom still so little is known.

Among the expenditures you will find the item of $128.43, the balance of a loan which we borrowed from the funds of the Shanghai Museum, with this item our old debt to the Museum is extinguished, and in the next year's account it will no more appear.

The "house expenses" show the usual annual average, as it is impossible with all economy to reduce them any more; the same remark applies to the "advertisements," and to the item of "expenses for transmitting journals."

Item "rent to the Shanghai Library" really belongs to the account of the Shanghai Museum, but should this expense be thrown upon that institution it would jeopardize its existence, as it has no means to defray it; this sum of Tls. 150 might therefore be looked upon rather as a grant given by our Society to the Museum.

The advance made to the "Celestial Empire" amounting to $126.76 really belongs to our 1879 expenditure, as it was for the printing of our next Journal. The same remark applies to the next item "tracing and carving maps for Journal of 1878," amounting to $114.00, of which we hope that a part of it will be refunded to us by the author of the "Climatology of Eastern Asia."

The expenses for the small exhibition we had on our premises together with the two "Conversaziones" in connection therewith amount to $24.90, a very trifling amount taking into consideration the pleasure it afforded the community in general, and the success the undertaking itself has enjoyed.

The income of the Shanghai Museum does not by much fall short to that of last year's. Next year the deficiency may be greater as there will be no refundment of monies from the Asiatic Society to be expected any more, the latter having paid up what was due to the Museum. While the income of the Museum for 1879 will thus be considerably curtailed, the expenditures on the other hand will be less inasmuch as the expense incurred for show cases, etc. will fall out. An extra expense will, however, have to be considered in order to increase the amount of fire insurance, the present sum Tls. 1,000 being inadequate to the value of the Museum's property say about Tls. 2,000.

The Shanghai Museum having gradually grown into popularity as an interesting and useful institution we may fairly count upon the continuance of the grant of Tls. 250 from the Municipality without which its existence would be doubtful.

JOSEPH HAAS,
Hon. Treasurer.

BALANCE SHEET OF THE

North-China Branch of the Royal Asiatic Society,

For the Year 1878.

1878			$	c.
Sep.	3	To proceeds from sale of Journal	41	80
Dec.	31	,, Subscriptions collected in 1878	859	50
		Balance due to Treasurer	107	64
		Total...	$1,008	94

1878			$	c.
Jan.	1	Paid balance due to Treasurer from 1877	190	42
,,		,, balance of loan due to Shanghai Museum, Tls. 93.48	128	43
Dec.	31	,, house expenses, viz:—taxes, insurance, gas, coolie, wages, etc.........	112	89
	31	,, expenses for Library, as bookbinder, etc.	6	90
		,, advertisements..............	79	72
		,, expenses for transmitting Journals	13	87
		,, rent to Shanghai Library, Tls. 150..................	206	05
		,, "Celestial Empire," advance for printing Journal of 1878	126	76
		,, tracing and carving maps for Journal of 1878	114	00
		,, extraordinary expenses, viz: Conversazione, shroff, etc.................	29	90
		Total...	$1,008	94

E. & O. E.

Shanghai, 31st December, 1878.

JOSEPH HAAS, *Hon. Treasurer.*

BALANCE SHEET OF THE

Museum Fund of the N.-C. Branch of the Royal Asiatic Society,

FOR THE YEAR 1878.

1878			Tls.	c.	1878			Tls.	c.
Jan.	1	To balance of 1877	87	95	Jan.	31	Paid carpenter for cases	102	32
Mar.	8	,, balance of loan to N.-C. B. of the R. A. Society	93	48	Mar.	28	,, Recreation Fund, interest on loan, Tls. 1,500	75	00
,,	20	,, sale of birds....................	1	92	Apr.	13	,, fire insurance	8	00
Apr.	8	,, grant of Municipal Council	250	00	Dec.	31	,, taxidermist's wages and utensils for Museum......	208	01
					,,	31	Balance in hand of Treasurer...	40	02
		Total...	Tls.433	35			Total...	Tls.433	35

E. & O. E.

Shanghai, 31st December, 1878.

JOSEPH HAAS, *Hon. Treasurer.*

LIBRARIAN'S REPORT.

As stated in the various reports of my predecessors the Society has not been able to acquire by purchase any books, all the additions to the Library have been donations by authors and exchanges with other learned Societies.

Appended is a List of Works presented to the Library during the year 1878.

P. G. von MÖLLENDORFF,
Hon. Librarian N.-C. B. R. A. S.

LIST OF WORKS PRESENTED TO THE LIBRARY OF THE NORTH-CHINA BRANCH OF THE ROYAL ASIATIC SOCIETY DURING THE YEAR 1878.

1. Reports on Trade for 1876 and 1877.
2. Returns of Trade for 1876 and 1877, Part I.
3. The same in Chinese.
4. Medical Reports, 15th issue, 1878.
5. W. F. Mayers, The Chinese Government. A Manual of Chinese Titles, categorically arranged and explained, with an appendix. Shanghai, 1878, 8vo.
6. Annual Report of the Board of Regents of the Smithsonian Institution. Washington, 1876, 8vo.
7. Smithsonian Report, 1875, 1876.
8. Smithsonian Contributions to Knowledge, Vol. XX and XXI. Washington, 1875, 1876, 4to.
9. Bulletin of the Essex Institute, Vol. VIII, Nos. 1-12, 1876, 8vo.
10. Annual Report of the Trustees of the Museum of Comparative Zo-ology at Harvard College in Cambridge. Boston, 1876, 8vo.
11. F. Scherzer, Journal d'une Mission en Corée par Koei-ling, Ambassadeur de S. M. l'Empereur de la Chine près la Cour de Corée en 1866. Paris, 1877, 8vo.
12. R. K. Douglas, The Life of Jenghiz Khan. Translated from the Chinese. With an Introduction. London, 1877, 8vo.

13. Oestereichische Monatsschrift fur den Orient. No. 12, Dec. 1877. Nos. 1-10, 1878.
14. Bulletin de la Société de Géographie. Oct., Nov., Dec., 1877. Jan., April, May, June, July, Paris, 1878.
15. Monatsbericht der Kgl. preuss. Akademie der Wissenschaften zu Berlin. Jan., Febr., Marz, April, May, June, July and Aug. 1878.
16. Department of Agriculture. Washington, 1877.
17. Naturhistorische Hefte, herausg. vom ungarischen National Museum. Budapest, 1877, Vol. I.
18. L. von Lóczy, Die Liszkovaer Hohle im Baráthegy. Budapest, 1878, 8vo.
19. Atti della R. Akademia dei Lincei. Transunti, Vol. II, fasc. 1-6. Roma, 1878, 4to.
20. Repertorio Sinico-Giapponese, fasc. III. Firenze, 1877.
21. Mittheilungen des Vereins fur Erdkunde zu Halle a. S. 1877.
22. Proceedings of the Ninth Annual Session of the Am. Philological Association. Hartford, 1877.
23. Proceedings, Am. Oriental Society, 1877, 1878.
24. Proceedings of the R. Society of Edinburgh, Vol. VI-X.
25. Boletin Astronomico de Mexico, 1878.
26. Legrand, La Nouvelle Société Indo-Chinoise. Paris, 1878.
27. The Entomologists Monthly Magazine. London, 1878, June.
28. A. M. Tudom. Akademia Évkonyvei, 1875.
29. C. B. H. von Rosenberg, Reis tochten naar de Geelvinkbaai op Nieun-Guinea in de Jaren, 1869 en 1870. 'S. Gravenhage, 1875, 4to.
30. A. Agassiz, North American Starfishes. Cambridge, 1877, 4to.
31. Trübner's Am. and Oriental Literary Record, No. 129-301, 131-32, 133, 134. 1878.
32. Transactions of the Asiatic Society of Japan, Vol. VI, Part I, II (3 copies), 1878.
33. Second Report of the Chinese Polytechnic Institution. Shanghai, 1878, 8vo.
34. Bijdragen tot de Taal-Land-en Volkenkunde van Nederlandsch-Indie. Derde Volgers: X, 1, 2, 3; XI, 1, 2. Vierde Volgers: I, 1; Verslag, 1851-1876.
35. Proceedings of the Royal Society. Vol. XXV, No. 175-178; Vol. XXVI, No. 179-183. 1878.
36. Journal of the Statistical Society of London, Vol. X, Part I (1847); XII, 1 (1849); XVI, 3, 4 (1853); XL, 1-4 (1877); XLI, 1 (1878.)

37. Proceedings of the R. Geographical Society, Vol. X, 1 (1865); XII, 1 (1868); XVI, 4 (1872); XXI, 2-6 (1877); XXII, 1-3 (1878.)
38. The Journal of the R. Geographical Society, Vol. XLVI, 1876; XLVII, 1877.
39. Mittheilungen der Geographischen Gesellschaft in Wien, 1877.
40. Journal of the Straits Branch of the R. As. Society, Vol. I, 1878.
41. Revd. J. B. Hartwell, The Foochow Essays. Shanghai, 1877, 8vo.
42. C. Alabaster, The Doctrine of the Chi.
43. ———, The Triune Powers, Amoy.
44. Sitzunzsberichte der mat-phys. Classe der K. b. Akademie der Wissenschaften zu München. Heft, 2, 3 (1876); 1, 2 (1877.)
45. Gümbel, die Geognostische Durchforschung Bayerns. Rede, 1877, 4to.
46. Sitzungsberichte der philos.-philol. und hist. Classe. München, 1876: 4, 5; 1877: 1, 2.
47. Carl von Prantl, Verstehen und Beurtheilen. Festgabe, 1877, 4to.
48. Dollinger, Aventin und seine Zeit. Rede, 187, 47to.

Shanghai Museum.

REPORT OF THE CURATOR FOR THE YEAR 1878.

The Curatorship of the Shanghai Museum of Natural History having been in my hands since November 1877, that is above a year, I now beg to hand to the Council of the North-China Branch of the Royal Asiatic Society my report hereon and also take advantage of this opportunity to make some suggestions towards the improvement and enlargement of the said Museum.

Since November 1877, one hundred and thirty-seven birds have been presented to the Museum; the greater number from Shanghai and its neighbourhood, some from Ningpo and Chinkiang, and a few from Chefoo. Amongst them we met with only fourteen new to the collection. They were:—

Some couples of the Mongolian grouse (*Syrrhaptes paradoxus*), bought in the Shanghai Market, known as Smith's Market.

A few specimens of the Japanese Ibis (*Ibis Nippon*) sent from Ningpo by Mr. J. A. Meyer.

A female Temminck Tragopan (*Ceriornis Temminckii*), sent by Mr. J. M. Young; also a female Darwin's Puckras Pheasant (*Phasianus Darwinii*), presented by Mr. W. M. Cooper, H.B.M.'s Consul at Ningpo.

Two specimens of the Albatross (*Diomedea Derogata*) were received; an adult one from the Chusan Islands, sent by Captain Croad, and a young one in its brown plumage sent from Chefoo by Mr. Donnelly. Unhappily as often happens with birds sent from distant ports, this last specimen arrived in too bad order to be mounted.

From Mr. Ballard, of the Kiangnan Arsenal, we received the only specimen of Tantale (*Tantalus leucocephalus*) we possess.

A Chelidon lagopoda, taken at sea by Mr. Knot, was also added to the collection.

I myself brought from Chefoo a pair of storks (*Ciconia Nigra*), of which one in young plumage has been placed in the Museum as the only representative of the species. The other one is

still alive and will be sacrificed to science when in full adult plumage.

A parrot is also new to the collection, but its origin is doubtful. To Dr. Burge we owe a beautiful specimen of the Great-Belted Kingfisher. A very rare bird of the same species was sent to the Museum by Mr. G. W. Hayden, Lightkeeper on the Island of Sha-Wei-Shan. Unhappily it was not in a condition to be mounted, and we had to preserve the skin simply by drying it.

With one or two more birds which I have not been able to name yet, I close the list of the additions to the ornithological collection.

This makes up the total of the birds to about four hundred, but as the Chinese birds described or named in Abbe David's beautiful work "*Les oiseaux de la Chine*" are eight hundred and thirteen in number, it is evident that we are far from having completed the collection. However with a few exceptions, most of the northern birds are in Museum; but owing to the difficulty of sending animals in the flesh from distant ports, or of finding men able to skin them properly there, we are poor in southern birds, and it would be a great boon to the Museum if a good correspondent and collector could be found in Hongkong, Canton, or Manila, perhaps even Singapore, as many of the birds of these southern shores migrate in summer as far north as Shantung.

The Museum's collection of Mammals and Reptiles has also been enlarged. Among the most valuable of these additions we must mention a large Fur Seal from the Japanese northern seas. A female of the *Hydropotes inermis* has been bought in the Shanghai market; we still want a good old male with tusks. A grey-breasted squirrel (*Sciurus griseipectus*) was offered by Mr. Krauss and two Angier's Deers were given by Mr. F. B. Forbes.

In September the carcase of a Russian Bear was sent from The Farm, some parts of it being already in a state of decomposition. Our native taxidermist Mr. Clement Wang took great pains in preparing it under my directions; but we failed entirely owing to the heat. Had we possessed a proper dissection room we might have succeeded better.

The two lower jaw bones of a Japanese Whale were recovered from an adjoining timber yard, where they had been placed with some lime to dissolve the fatty tissue attached to them.

But of all the most important addition to the Museum is the still little known Chinese Alligator, of which two specimens have been received. The first, an adult male, was dug up from its

burrow in the neighbourhood of Wuhu, and was presented alive to the Museum by Mr. J. L. E. Palm. It was dissected and mounted, and adorns our collection. The second specimen, a female, was received from Chinkiang in October, and kept alive till December 24th, when it died. The carcase was placed in spirits of wine and sent in January 1879, to Mr. A. Milne Edwards, the learned Curator of the Paris Museum, to be studied and named, as it appears to be a new species.

The number of Insects, Molluscs, and Snakes has been increased by only a few specimens. One Butterfly new to the Museum was found by me in the Shanghai Public Garden.

Of fishes we received two or three only, and I could have made a very decent collection had we proper accommodation and more room. We have only wretched glass tubes made here, which always leak in summer, and still more wretched looking jars or bottles of every form and shape, of all shades and colours, descript and nondescript; old jam pots, preserve bottles, medicine vials, with the names of Crosse and Blackwell or others cast on them. This is really a part of the Museum I am ashamed of; but the sinews of war, which are also those of science and progress, are missing. "*Pas d'argent, pas de* "*suisses*" say the French; no money, no collections, echoes the Curator of the Museum. Under such difficulties it is indeed impossible to make any serious attempt to form a collection of Chinese fishes.

This collection I consider a most important one, as this branch of our Chinese Natural History is still little known; there is no good work yet published on Chinese fishes. Consequently, I would strongly recommend the Society to spend a certain sum of money in buying proper glass jars at home, then decent looking *étagères* could be built for their reception, and the Shanghai market would furnish us at once with a goodly number of curious fishes.

I do not know how many pet dogs and birds have been stuffed for their afflicted owners. A good many boar-heads, foxes, and birds, have also been mounted as trophies for the proud Nimrods who have distinguished themselves on the hunting grounds of the Celestial Empire. But no list is kept of these, and the charge of half a dollar or more for such work made is, by a rule which I found established, the benefit of our taxidermist.

A few skins of birds kept as duplicates were also sold to private collectors for the benefit of the Museum. Unhappily we have no room, no accommodation, to keep a stock of these

commodities, and this is another of the desiderata or improvements suggested.

Three new glass cases have been added during the year to contain the new objects, but when I ask for more I am reminded that the Museum has been put in debt by this extravagant expense, and that there is no more money forthcoming.

In the way of an herbarium we have nothing, and really it is useless attempting to create one before we have room to place it, as the Museum is already quite full.

I should recommend that some skeletons of the typical Chinese Mammals, Deer, Tiger, etc., be procured and mounted, but alas, where are we to put them ?

An important improvement was tried last year in endeavouring to start a Mineralogical collection, and our President, Mr. T. W. Kingsmill, gave for this purpose his valuable collection of minerals and fossils, which can form a good nucleus for the practical illustration of Chinese geology, another branch of our Natural History which is little known. I am sorry to say that one third of this collection is still unprovided with a show case, for the reason I have already stated.

It is great pity, for Chinese fossils are not known at all. I have endeavoured to increase this mineralogical collection, and have already received through Captain Anderson of the Chinese Revenue Cruiser "Kua-shing" samples of the different rocks of the Islands in the neighbourhood of Shanghai and Ningpo. I intend moreover to write to the engineers in charge of the coal mines now in process of opening in Chihli, Formosa, and Anhuei, in order to invite them to send to the Museum samples of the different strata traversed by the borings and some of the most important fossils. My colleague, Mr. Keymeulen, Assistant-in-charge of the Customs at Keelung, has already promised to interest himself in this matter.

But then we must renew our demand for space. We have really none left in the only room now constituting the whole of the Museum, and supposing that funds are subscribed for the keeping of the institution, they will be of little use as long as the increase of the collections is checked by this want of space.

We must also mention that a valuable collection of books on Natural History was added to the Museum Library. It consists of works belonging to the late Curator, Mr. J. P. Martin, and which, thanks to the liberality of his friends and of some lovers of natural science, were purchased from Mrs. Martin for the sum of 500 Dollars. They are now placed in the cupboards under the show cases for want of a more available and convenient

place. A list of these books is here appended. This is the place to mention that we do not possess yet the most important of all books for the Museum, that is the excellent book on the Birds in China published last year by M. l'Abbé Armand David. In order to be able to classify our collection, I have been obliged to buy a copy at my own expense, as I knew well that our exchequer could not bear the expenditure of six pounds sterling which it necessitates. If money is once more forthcoming, I strongly advise the Council to procure that book, as well as that of Siebold on the Birds of Japan. I am told that another book on the Birds of China is now in preparation in England from the notes and publications of the late Mr. Swinhoe. I dare say it would be also a necessary adjunct to our collection. Sending skins home for identification is a very good thing, but it often occurs that they never come back any more, or at least that the best ones are kept in order, it is said, to recognise the services of such and such Museum towards the North China Branch of the Royal Asiatic Society. I have some experience of this kind of friendship between scientific bodies, and I strongly advise the Council not to allow any rare skins or specimens to leave the Museum, unless it is altogether intended as a gift, for which no returns is expected, except perhaps in books or publications. Some exchanges may be made, but unless they come from Eastern shores of Asia I do not care very much for them. Indeed, our Museum is already far too small to receive the whole of the objects necessary to illustrate the Natural History of China. Why should we attempt generalization? Except in the very largest cities as London, Paris, New York, etc., it is absurd to attempt to collect everything, and scientific people at home are more and more advising the formation of local museums, as the only means of discovery and progress, the generalities of science being pretty well known in our enlightened century. Such I think must be the aim of our Museum curators. Let us illustrate China, and perhaps Japan as it is closely allied in everything, as well and completely as possible; let us collect for our library all the new works on Chinese and Japanese Natural History, publish our new discoveries, and then the Shanghai Museum will be of good use, not only to our increasing community but also to the scientific world at large.

I think there is yet another way in which the Museum could be made useful to the public. From the occasional demands I have received now and then from merchants, for information about various Chinese produce, as hemp, jute, China grass, silk,

it would be perhaps very useful to make in the Museum a collection of the raw products of the Empire.

This would be a kind of commercial collection, which could be accompanied by small models of Chinese machines, etc. If not of great use to merchants it would certainly help them sometimes and aid to the practical education of children destined for trade. It would be easy to procure those samples.

But before thinking of days of glory and use for our Museum, we must turn our eyes to stern reality and make first the necessary repairs to its roof, which leaks badly, endangering the safe custody of the existing collection.

As you will gather from this report, the wants of the Museum are threefold, 1st, repairs; 2nd, more space, and 3rd funds. I should perhaps place first this 3rd consideration, as it is evident enough that we cannot go on repairing without money.

The Municipal Council last year kindly granted us a sum of 250 Tls. for which we can show good use. We must now turn beggars again and implore more assistance, without which we must perish. Now I do hope for the sake of science that the enlightened population of the Model Settlement, always, so ready for progress that it is even mooted by a company of intelligent men to introduce here the electric light, will not allow the useful institution of the Museum to fall to the ground. Museums are indeed becoming daily of more importance in the practical and scientific education of men.

We already possess good schools in Shanghai; some more are contemplated, or even in progress, for the education of both Foreign and Chinese children, and I am sure I cannot be mistaken in saying that the Museum, enlarged as I propose, will be a practical and necessary adjunct to these schools. I am glad to say it has been already understood in this way by the best of our existing schools. The Jesuit Fathers have indeed sent their pupils to visit our collection, and you all know that their Museum in Siccawei, for which they have lately received a skilful taxidermist from Paris, was established for this purpose.

In conclusion, the most important of all things now for the Museum is the sinews of war which are also the sinews of science and progress, that is money. I hope you will excuse me for always asking for it, but if Cato's of old often repeated "*Delenda est Carthago*" ended in success for Rome, I dare say to you, without comparing myself to the old severe censor, and with hopes of glory for Shanghai, go to Mecènes, that is the Municipal Council: "*Petite et Accipietis.*"

Address to the Members

OF THE

N.-C. BRANCH OF THE ROYAL ASIATIC SOCIETY,

DELIVERED AT SHANGHAI, 3RD FEBRUARY, 1879,

BY THOS. W. KINGSMILL,

President.

IN closing the second year during which it has been my privilege to act as your President, it is but right that I should pass in review the more salient points of those investigations in which our society is more especially interested; in the hope that more attention may be paid to many of the important topics on which information may be gained in China.

Although in many respects we are here at a disadvantage compared with those working in Europe, and although we have no official support of any kind to scientific research, and but few means of making ourselves acquainted with the rapid march of science elsewhere; there are conditions which render our position in some cases an advantageous one.

We have ready access to the stores of Chinese records handed down from an antiquity at least respectable, and we enjoy means of making ourselves acquainted with a literature but little studied or comprehended in Europe.

If we ask have we made the best use of those opportunities, I fear that the answer must be in the negative, and that with but few exceptions we have been content to follow rather than to lead, and that most of the sound and useful work already executed has been performed by students at a distance from China.

It is thus that the years immediately past have been marked by few extensions of our knowledge of China, and both our literary and political relations have remained almost in *statu quo*. Few new investigations have been commenced, nor has the period been productive in bringing to an issue former controversies. In the physical sciences our gains have been few, and

the passion for geographical exploration which has so much extended our knowledge of other regions has left China comparatively neglected. Our maps of China are still remarkable for what they omit rather than for what they contain, and its geology and mineralogy remain almost untouched.

In what has been done, however, our Society has continued to hold a high place, and has afforded a stand point where men of differing views have been able to meet on common ground without their differences lending to polemical disputes, and it therefore remains for the members to advance in the future the objects for which we have been formed by themselves moving forward in original researches, or by aiding and abetting by their influence and position those who are willing to assist in the work.

This is the more necessary that our Society has had during the past two years to regret the loss by death or departure from China of many of its most distinguished members. In its recent issues the names of the contributors will, for the most part, be found to be new, and this alone, while it holds out a prospect of future usefulness, should lead us to emulate the zeal and learning of those who have gone before.

Among those who have passed away the name of Charles Wickliffe Goodwin, who has in former times occupied the chair to which you have done me the honour to call me, will long be remembered. Although his early predilections led him to become a master of Egyptian antiquities, his was a mind which could not fail to take an interest in all that concerned philology and ethnology, and to his advice and assistance always willingly given I have myself been frequently indebted. The death of William Frederick Mayers who had risen to the first rank as a student of China and the Chinese, and who has often enriched our pages out of his wonderful stores of Chinese lore has also been a severe loss to our small Society. The volume of our transactions just published contains in an interesting account of Chinese Burial Rites one of the latest of his many investigations. Robert Swinhoe, F. R. G. S., F. Z. S., many of whose valuable and original contributions to our knowledge of the natural history of China are to be found in our Transactions from time to time, has also passed away. Mr. J. Patrick Martin to whose exertions we owe much of the success of our natural history museum is not the least regretted in our list of deceased members.

Besides these losses by death we have to regret the severance from us from other causes of many of our oldest and most active members. Dr. S. Wells Williams, our honorary member,

well and favourable known during his residence in China to many who but for him would have known but little of its history and productions, now enjoys at Yale College the distinguished position of Professor of Chinese. Mr. George F. Seward for some years our President, has been removed by his government from Shanghai to the more dignified position of United States Minister at Peking. Sir Walter Medhurst, also for many years an occupant of this chair, has retired to spend in private life a well-earned and learned leisure.

Perhaps, however, the Society has most to regret the loss of the personal services of our late Vice-President Mr. Alexander Wylie, whose unobstrusive services will long be remembered by those who had the privilege of acting with him. Profound in his knowledge of Chinese his learning was always at the command of the conscientious enquirer, and to his advice and assistance, at all times willingly rendered, many members of our Society owe much of the interest they have been induced to take in Chinese researches. At the request of the Council, Mr. Wylie kindly undertook to represent the Society at the Congress of Orientalists held at Florence last year, and his appearance there in that position cannot fail to be a source of congratulation to our members.

Although tardy in its appearance owing to the large number of tables contained in it, the Journal of the Society for the past year maintains the position occupied by its predecessors.

The synchronous famines in India and Northern China have called attention to the metereology of Asia, and in the papers contained within the volume on Famines in China, on Sun Spots and Sun Shadows, and on the Meteorology of Eastern Asia, there is much which will form the ground-work of future research. The curious tables of Sun Spots observed in China long before Europe had an inkling of their existence, and for which we are indebted to Mr. Hosie, of H. B. M.'s Consular service, will doubtless aid, in connection with his other paper on Droughts and Famines in reducing to a regular rule these latter calamities. Toward this end the observations on the meteorology of Eastern Asia, now for the first time tabulated by our distinguished member Dr. H. Fritsche will greatly tend.

Fortunately at their observatory at Sicawei the Reverend Fathers have introduced a system of observations second in completeness to few in the world. Continuous self-recording observations are made on the temperature, barometric pressure, condition of the atmosphere, and the intensity and direction of the magnetic current. These are checked by frequent observ-

ations of the instruments at stated times, so that any irregularity is immediately noticed and corrected.

These extended observations, commenced in 1874, and the first annual record of which was published under the auspices of our Society, have been continued and enlarged from time to time, and the annual record now fills a goodly quarto. Situated as Shanghai is near the northern limit of the summer monsoon of Eastern Asia, and in consequence subjected to excessively variable hygrometric conditions. no better locality could probably have been adopted for the erection of a first class meteorological observatory.

Although within the past year we had no such paper on Natural History as that published in our previous Journal by Dr. von Mollendorff, it will be interesting to members at a distance to learn that the Museum of the Society at Shanghai is gradually extending its sphere of usefulness. Owing to the public spirited liberality of the Municipal Council its most pressing wants have been met by an annual grant. The private liberality of the foreign residents at Shanghai has likewise, during the past year, enriched the library attached to the Museum by the purchase of some four hundred volumes, the property of its late Curator, Mr. Martin. Under the auspices of our present able Honorary Curator Mr. A. A. Fauvel, the space at the disposal of the Museum Committee is found to be becoming gradually straightened, and some steps must be taken to increase the accommodation, if the growth of the Museum is to be continued.

One extremely interesting and important discovery in natural history has, during the past year, been announced by Mr. Fauvel, and that is the discovery of a species of alligator inhabiting the rivers of China, or at least the Yangtsze, whose nearest analogue is to be found in the *Alligator Lucius* of the Mississippi. One of the most recent authorities Mr. A. R. Wallace remarks (Geographical Distribution of Animals, Vol. II., page 406) "The Alligators which are distinguished by having both the large front teeth and the canines fitting into pits of the upper jaw, are confined to the neotropical and the southern part of the neartic regions from the lower Mississippi and Texas through all tropical America, but they appear to be absent from the Antilles. They are all placed by Dr. Gunther in the single genus *Alligator*." As Alligators have been found in Eocene beds in England accompanied by Gavials and Crocodiles, Mr. Wallace attributes their present distribution to partial ex-

tinction. This opinion will doubtless be strengthened by Mr. Fauvel's recent discovery.

In exploration there may be mentioned Captain Gill's journey from England to Assam which was successfully accomplished. Col. Prejevalsky who nearly succeeded in reaching Thibet in 1872 has made a second journey of even more geographical interest in Central Asia to the basin of lake Lob hitherto unvisited by Europeans. Southeast of the lake he discovered a lofty range of mountains, the Altyn Tagh, and also learned some details of the mysterious Charchan of Marco Polo whose identity has been so frequently disputed. Although Col. Prejevalsky certainly penetrated to the basin of lake Lob it seems to admit of doubt whether the lake be discovered occupied the lowest part of the basin. The fact of his describing it as fresh seems to indicate that the ultimate recipient of the waters of the Tarim has yet to be found.

This present winter Count Szechenyi accompanied by Lieut. Kreitner of the I. R. Austrian army and Mr. Loczy, a geologist of repute, has set out on an expedition to explore the unknown country lying between Suhchow in Kansuh and Llasa. It is pleasant to learn that the expedition has me with friendly assistance from the Chinese government. It is much to be hoped in the interests of science that Count Szechenyi's hazardous expedition may be rewarded with the success it deserves.

The members of the Society can hardly fail to take an interest in Professor Nordenskiold's bold attempt to complete the northeastern passage. By last advices received the Professor had safely rounded Cape Chelvuskin, the most northerly extremity of Asia, situated in lat. 77° 41′ N. and had reached the mouth of the Lena, which he left on the 27th of August last to continue his voyage to Behrings Strait. Should he succeed in reaching this point he may be expected in these latitudes towards the beginning of next autumn.

I could have wished that more attention had been paid to the very interesting problems offered by a study of the Ethnology of Eastern Asia. The Chinese section of the Congress of Orientalists at Florence, with the exception of a paper by M. de Rosny on some Ethnographic Identifications relating to Indo-China and Malasia, extracted from ancient Chinese writers, of which no detailed report has been received seems to have confined itself to tracks already too well beaten to be profitable or agreeable. We possess in the ancient writings of the Chinese many valuable indications of the early migrations of Eastern Asia, but understood as these have hitherto been by the unaided glimmer of the Chinese commentators it is a matter of little wonder that the result

has been insignificant. I may be excused for stating my own views on a much controverted point.

Proeeeding upwards towards the source of Chinese history our path begins to grow uncertain towards the 5th century B. C.; the seventh century supplies us with little better than legends mixed with historical recollections, and finally, at about 770 B. C. the utmost limit of what we can call consecutive history is reached in the removal eastward of the old capital of Chow and its re-establishment at Loh by P'ing wang. Regarding the destruction of the old capital Mencius (IV. 2 xxi.) tells us "When the traces of the royal sway (of Chow) were extinguished the art of ballad making was lost, and afterwards annals came to be made." 王者迹熄而詩亡,詩然俊春秋佳. The Ch'un ts'iu of Lu begins with the first year of Duke Yin 721 B. C. which is the earliest date in Chinese history for which we can find trustworthy authority. It is not far removed in time from the destruction of the old capital of Chow, yet the short interval of fifty years marks the transition from myth to history.

In the Analects of Confucius, *cir.* 500 B. C., we find that the state was without a head, and that each petty prince in his own territory did as he himself thought fit. Confucius does not seem to have been acquainted with any strong, tradition of the imperial government of Chow. He does indeed raise his voice against the assumption by the states of imperial sacrifices, but the traditions of empire in the later sense, if such had ever existed had died out. Rather indeed may we conclude from the opinions of Mencius expressed a century and a half later that they had as yet no existence. "How," said King Siang of Liang, "can the T'ien hia be settled?" The sage replies, "It can only be settled by being united under one sway" (Mencius I. 1. vi.)

The nearest analogue of the T'ien hia in the fifth century B. C. was not the feudal states of Europe in the Middle Ages, as has been thoughtlesslessly propounded, but Greece in the period succeeding the Persian war. The people of the several states were as proud of their common origin and common speech as were the Hellenes themselves, but the bond was not strong enough to induce concerted action. Chow indeed as the representative of the head of the family enjoyed a preeminence at the sacrifices and at the assemblies of the states, and acted as the eldest son in the family cult; but in the councils of the assembled states the voice of the Wang was heard but as an equal not a suzerain.

Already in the time of Mencius the oracles had commenced to *philippize.* T'sin loomed on the horizon of the states as Macedon lowered over Athens in the days of Demosthenes. Mencius

sought to excite one of the old stock to unite the conflicting interests of the Chow princes, but the thing was not to be done, and Prince Ching, as T'sin Shi-wang-ti, like Philip of Macedon in Europe, founded the first Chinese empire, to expire as did Philip's in the person of his immediate successor.

Whence came this race of Chow so rich in great names, and which was instrumental in establishing a cult and policy well nigh as lasting as that of ancient Greece?

The ballads spoken of by Mencius afford us an unexpected clue, and a closer inspection opens up to us a treasury of myth and legend comparable in some respects with that of the Hellenes themselves. The idolic character of the writing in which they have been preserved and handed down affords us but little information as to the language in which they were originally compared; we know, however, that at one time[1] the Odes conveyed to the ear the old legends and war songs of the Chows, and though now their sounds are lost, and we have to trust to a laborious analysis of the symbols presented to the eye, we find enough to justify us in identifying the roots with those of the old language of the Vedas, of the Gâthas or or the Hellenic bards themselves.

A prevailing mournful tone is to be noted as underlying the collection; a wail of lamentation at the ceaseless attacks of hostile foes, and this wail rises to its culmination in the latest of the ballads which tell of the final struggle of Chow with its Turkish foes, and the fate of Yü, the *Dark*, and his fair but frail bride Pao-sze (Prîtî, *Desire.*)

Wan Wang and his sons Wu Wang and Chow Kung do indeed appear in jubilant form in their conquest of Yam shâng. The familiar myth of the contest of light and darkness, which we shall see again reappearing, has woven itself into the tale of the great fight between the Chows and the Yins; its heroes are Ch'ang, the Effulgent (Wan wang), Fat, the Shooter *of rays* (Wu-wang) and Tan, the Dawn (Chow kung); Wei tsze k'i, the Morning Star and Pak kan the Northern Buckler warn the tyrant Chow[2]-sin or Show (Στυγερὸς or Στὺξ the Odious) of the coming day; Show, however, goes on with his villiany, and with his wife T'anki (Θάνατος, Θνῆσις) provokes more and more the vengeance of heaven. ꜀Chow 周 a modification of 晝 chow' (the Day) moves towards the doomed state; it occupies first the territory of Li, the region of the agriculturists, the pronunciation of which we learn from its value in proper names[2] was AR (*ar-are* to plough) and prepares for the great contest.

[1] Chinese Classics, V. 549-50.

[2] *E. g.* Li-kin or Im-tsai-li-kin, Samarkand, in the Shi-ki.

The struggle finally takes place in the east, in the wilderness of the herdsmen, Mùk yê, at the grey of morning. It was to no purpose that Yam shàng mustered its forces; those in front turned their spears on those behind, and the red glare rose higher and higher till at last it floated over the pole star. So the T'ien hia was settled, and Fat, as Wu Wang, the martial, became its ruler.

The mixture of myth and legend is evident. The Chows, Limin or Aryan men, attack the state of Yin, defeat the pastoral tribes and set up instead their own cult and polity. In the midst of the pœans of victory we find traces of the true reason of their approach. The war was none of their own seeking, and they brought with them a very consistent legend of their wanderings in search of a home.

"When king T'ai (T'àn-fû, Danu or Dànava) dwelt in Pìn (Mencius I. 2. xv.) the Tik tribes continually made incursions. He gave them presents of skins and silks, but could not escape their depredations; he gave them hounds and horses with a like result; he gave them pearls and jade, but still they harassed him. He therefore called the old men and told them 'What the Tiks want is our territory. This I have learnt, that a prince should not turn the sustenance of his people to their detriment. My children, why trouble yourself at the loss of your prince; I will leave you.' Accordingly he left Pìn crossed the Liang shan, built a city at the foot of Mount K'i, and established them his government. The people of Pìn said 'This is a benevolent man indeed and we must not desert him.' They followed him like crowds returning from market."

The songs of the Shi king are still more explicit in their recital of the migration, but the pith of the story is given above. T'an fu (called after the establishment in China of the kingdom of Chow, King T'ai), forced to flee from Pin to escape the inroads of the Turks who were there harassing the ancestors of the future conquerors of China, settled in K'i chow, the plain adjoining Lake Lob at the foot of the K'i shan, now the T'ien shan, and there set up the original kingdom of Chow. In those days the district was fertile, well watered and covered with wood, and the rising state seemed about to become powerful under its energetic rulers. To the south lay the state of Madh or 密 Madh-su 密須, *i. e.* Maddhal, with whose rulers the Chows soon came into hostile contact. Chow was victorious and the city of T'sung yung *i. e.* Dardan, the Charchan of Marco Polo was captured. Its great drum was long preserved, and we find it many centuries after still preserved in Tsin as a memorial of the contest.

The Liang shan crossed by the emigrants is phonetically con-

nected with the T'sung ling of later Chinese, and both point to an original form Dar. We thus learn that the mountains, crossed by T'an fu in his migration were those of the Dards, the *T'sung ling* of to-day; and this step takes us back to the previous seat of the Chows in the land of Pin.

Like K'i chow the settlement of Pin was not the original home of the Chows. Where that was the Chinese legends afford us no clue, but we do learn from the Shi king that unable to dwell at ease in their ancient home the tribe under the leadership of Kung liu crossed the Wei (? Oxus called 嬀 kwei or wei by Sze-ma T'sien) and settled in the highlands of Pin along the valley of the Hwang (Varsha, possibly the Vaksh.)

We are here brought into contact with the original birth place of Aryan legend, and there may therefore be the less surprise should I ask you to identify Kung liu of the Chinese legend with the Kereçaçpa, the serpent slayer, of the Iranians. Both are too near the extreme verge of legend to enable us to fix upon any definite act of their lives, but both seem to have been wanderers from their home. The Vendidad hints that Kereshaçpa took to witchcraft, and the Yaçna tells of how, having inadvertently placed his cauldron on the green slimy serpent, Çruvara, the serpent sprung up and Kereçaspa fled. The more modern legends of the Persians make Gersharp the last of the Pishdadians, who having reigned only nine years disappeared leaving no successor.

It is curious that the word kereçaçpa (in Zend *lean horse*) is evidently a corrupted form. The change of a single letter keredaçpa instead of kereçaçpa, *i. e.* the '*maker whole*,' gives a meaning to the legend of the serpent slayer, and accounts by the ordinary change of *d* to *l* for the Chinese form Kung-liu.

The usually received dates tally as closely as traditional epochs can be expected to do. The Chinese have fixed approximately on 1800 B. C. as the date of Kung liu's settlement, and according to the Avesta Kereçaçpa was antecedent to Zarathustra whom we most seemingly relegate to the sixteenth century B. C. The Turanian Fra*n*raçê was hanging at the time on the borders of the Iranian settlements and the latter found existence scarcely supportable. That a portion of the tribe should have emigrated eastward is in consonance with all we know of the migrations of the early inhabitants of Central Asia.

There are possibly traces of the old settlement of Pin to be found in the names of various localities of the Pamir, if that name itself, as suggested by Sir Henry Rawlinson be not a corruption of some such form as Pân-mir or Fân-mir, the lake country of Pân or Fân. There still exist the Fân tau, the Fân lake, etc. and

Strabo XI. 11 speaks of the Φαυνοὶ or Φρυνοὶ as bounding to the east the Bactrian kingdom.

The explanation I have offered, but merely in outline, reserving details for some other occasion, will serve to account for many peculiarities in the Chinese cult and Chinese tradition, and is not inconsistent with what we know from other sources of the original dispersion of the Aryas. Indian tradition points to the same period as having witnessed the southern migration of some of the tribes, while Persian legends tell of their settlements in Mid-Asia. The Aryan migration to China is in many respects similar to that into India. In both cases the Aryans penetrated into countries previously inhabited, and impressed on the original inhabitants their language, cult and polity. There is, however, one broad distinction to be noted. In India the early establishment of caste kept apart the conquerors and the conquered, and has preserved to the present day in more or less purity the original type. In China, though for a time the settlers kept themselves distinct from the people of the land, the traditions of difference of race were gradually relaxed, and we soon find that the Aryan Chows did not hesitate to admit into their family by adoption those neighbouring states whose power or influence was sufficiently great to make their alliance desirable.

The most remarkable instance of this practice was in the case of Wû, where a genealogy leading up to T'ai pak the eldest brother of Ki lik, and therefore if true constituting them the representatives of the eldest branch, was found for the rulers of the state. It is curious to observe that on one occasion when the various princes met at Hwang ch'i to discuss the position of affairs, Wû actually raised a claim on this genealogy to the headship of the states. The claim was indignantly repelled by Tsin as head of the Ki clan and might have led to bloodshed, but that at the moment a messenger arrived to tell the prince of Wû of the invasion and impending destruction of his state. The connection of Wû with the other states had all along been looked upon as something disreputable by those of the genuine stock, but these little discrepancies had to be passed over so long as Wu occupied a position of power; and when finally it collapsed as an overblown bubble, its fall was so complete that it was not worth while erasing its name from the family records.

The same process went on all round, T'sin and T'sû were adopted into the confederacy, and at one time the preliminary steps were taken for admitting the Hiung nû, and a genealogy leading up to the Great Yu was actually prepared.

This policy was not long in making itself felt. The Chows in-

deed succeeded in impressing their cult and laws on China, and to a very considerable extent their language, fully half the roots of modern Chinese being traceable to Aryan sources. The admixture of race told, however, rapidly on the speech of their descendants, and it soon lost its inflected form, and even before the rise of T'sin had assumed in great measure its present monosyllabic form. The race characteristics of the Chows gradually died out, as race characteristics usually do where a limited number of immigrants settle in an already inhabited country, and freely ally themselves with the original stock. It is only, in fact, by a laborious process of elimination that we find in the Chinese of to-day lingering traces of the Aryan occupation.

A closer search, however, discloses remains of a partial immigration antecedent to that of the Chows; and on these traces, slender though they be has been erected the fabric of the so-called ancient history of China. It may be remembered that Chow at the battle of Mûk yê vanquished the forces of Yin, but the manner in which, according to tradition, the victory was utilized shows that even in the conquest of the tribe its consanguinity was recognised. Wei tsze k'i, who had fled to meet the coming dawn, was appointed to continue the sacrifices of Yin; and we find the rulers of the petty state of Sung 宋 claiming within historic times the honour of being his descendants. Sung possessed legends of the contest of dawn with darkness as definite as those of Chow itself, and couched under names only dialectically different and betokening as plainly an Aryan origin. In Greece where each city believed its inhabitants antochthonous these differing versions of a common story would have been allowed to remain separate and distinct, but in China they were made to form a thread of quasi connected history, and hence it became necessary to invent a prior invasion of a previously degraded race. Hence the invention of the dynasty of Hia (Hari) and the foisting into it of the old gods gradually displaced by the growing pantheism of the settlers. Hence the legend of T'ang corresponds even to its details with that of Wan and Wu wangs, and the descendants of Yaou, Shun and Yü (Varu*n*a, Vish*n*u and Manu) end in the miserable Kit (Σκοτός) and his wife Mehi (Megha the Cloud.)

Even beyond Yin T'su seems apparently to have had traces of Aryan influence. The few words of the language preserved, which we learn from Mencius was unintelligible to the rest of China are referable to Aryan roots. Still the jealousy with which T'su's march to power was regarded by the other states and the prolonged refusal to consider it as other than barbarian, seems to

point out that the traces must even then have been very indistinct.

It would not be possible within the limits permitted to an address like the present to point out in detail all the reasons which have led me to form these conclusions. I have brought them forward in the hope that other students of the antiquities of China may turn their attention to the very fertile ethnological field which lies before them. Facts we know are very stubborn things and not to be controverted with impunity, but the same immunity does not rest with the conclusions we may be tempted to draw from them. In no science are these conclusions more open to animadversion in its present condition than in that of ethnology, and I trust that my hearers, while giving me credit for a careful collation of facts, will not assume that the conclusions I have drawn are in any sense incontrovertible.

Those, however, who have watched the progress made in Europe by means of comparative study, towards gaining an insight into the original condition of the Aryan family, will not lightly slight any traces, however, slender of their influence in Eastern Asia. No sufficient explanation has yet been afforded for the remarkable coincidences between the early Chinese cult and civilisation and that of Western Asia and Southern Europe. The near approach in time of the origin of two, and the evidence of early intercommunication in the identity of their astronomical and calendaric systems, has always been accepted as a proof that intercourse between the two did exist in times immediately antecedent to history. The nature of this intercourse has hitherto been concealed, because when history opens the intrusion of the Turkish tribes had already placed an impassible barrier between east and west. It is therefore a matter of interest to discover that the effect of this intrusion was to drive eastwards a portion of the mid-Asian peoples, because it not only throws light on Chinese ethnology, but also aids us to understand better the Iranian legends of tne pressure of the barbaric tribes on their own frontiers.

In a previous address I pointed out what seemed to me the exciting cause of the irruption of the Turkish tribes into Central Asia; but as this trends on geological enquiries, and I do not propose to renew them this evening, I shall close by recommending to the members of the Society and others interested in the antiquities of the Far East a reconsideration of the ethnological question.

The progress of ethnological and philological science has been much retarded by the apparently necessary assumption that the Chinese language and Chinese arts had to be relegated to an inde-

pendent origin. The fiction of inflective and agglutinative languages has also been a retarding influence. The fact seems to be that all languages are liable to pass through both stages. Sanscrit is a language only just emerged from the agglutinative stage, and Chinese seems to be one which after adopting inflections has gone back to the former condition.

A third fallacy I have to warn students of Chinese against is the misuse of the word Turanian as applied to peoples and tongues. According to Persian tradition Tûr was equally with Selm and Iredj the son of Feridûn. The modern use of the term Turanian to include all tribes in northern and eastern Asia not supposed to be Aryan has no foundation in fact or tradition.

JOURNAL

OF THE

NORTH-CHINA BRANCH

OF THE

ROYAL ASIATIC SOCIETY.

ARTICLE I.

ALLIGATORS IN CHINA.*

BY

BY A. A. FAUVEL, ESQ.

Imperial Chinese Maritime Customs,
Bachelier ès Sciences de l'Université de Paris and Honorary
Curator of the Shanghai Museum.

IF we consult the oldest of all Chinese records, the Classics, in which many of the natural productions of the country are noted, we find in the twenty-sixth chapter of the Doctrine of the Mean (1) a curious enumeration of the wild animals living in the waters. In Dr. Legge's translation it runs as follows :—" The water now before us appears but a ladleful ; yet extending our view to its unfathomable depths, the largest tortoises, *iguanas*, *iguanodons*, dragons, fishes and turtles are produced in them." (黿鼉蛟龍魚鱉生焉.) (*Yuan t'o chiao lung yü*

* Read before the Society on the 13th December, 1878.

(1) 中庸. 二十六章. 九節.

pieh sheng yen.) The Chinese commentary (中庸說) on this passage defines the *Yuan* 黿 as 'the first produced of the chelonia' (介蟲之元); the *Lung* 龍 as 'the chief of scaly animals'; the *Pieh* 鼈 as being 'a kind of *Yuan*'; the *Chiao* 蛟 as being 'a kind of *Lung* 龍'; while the *T'o* 鼉 'has scales like a fish, feet like a dragon, and is related to the *Yuan*.' From this we may infer that the *T'o* is an amphibian with feet and scales and allied to the chelonians.

The *Li Ki* (禮記) says: "in the ninth moon they kill the *Chiao* and capture *T'o*" (to be sent to the palace of the Emperor where drums are made from its skin, according to the commentators.)

Proceeding further, we find in the 4th stanza of the eighth ode of the *Shih King*, decade of *King Wang* (2) the following sentence:—鼉鼓逢逢 *T'o ku peng peng*, translated by Dr. Legge "The lizard-skin drums rolled harmonious." The commentary is the same as the preceding one, indeed we find it in every book quoting the *T'o*.

In the Doctrine of the Mean, Dr. Legge translates *T'o* by *Iguana*, and in the *Shih King*, he gives *Lizard*. Not knowing, probably, of the existence of crocodilians in China he was left with Chinese dictionaries to determine the exact meaning of the character *T'o* (鼉), and I must say that the ambiguity of their statements is such as to render it difficult to get at their exact meaning.

Now, according to *Choo's* commentary quoted by the translator (Dr. Legge), the great drum was eight cubits in length and four cubits in diameter at both ends. Other Chinese authors say that it was made with the skin of the *T'o*. How could it be covered with the skin of the Iguana, which never exceeds five feet in length, or with the skin of a lizard which is far too thin and too small for even the smallest of drums? Besides the Iguana cannot be said to be produced in the waters with fishes, chelonians, turtles, etc., for it is not an amphibian animal, and I have never heard of it being found in China. I could say the same of Iguanodons. The *T'o* then is not an Iguana; let us now try to make out, with the help of the Chinese dictionaries, the exact meaning of the character 鼉.

One of the oldest, the *Shuo Wen* (說文) says: The *T'o* is an aquatic reptilian (水蟲) (3) *resembling the lizard* (蜥蜴)

(2) 詩經. 大雅三. 靈臺. 四章.

(3) Dr. Legge translates 蟲 chelonian (see above.)

and measuring *over ten feet in length.* A lizard of this size can only be a kind of crocodile or Alligator.

In *Kang Hi's dictionary* (康熙字典) we find, besides the above quotation of the *Shuo Wen*, that the *T'o* has *scales as hard as iron* and *a very thick skin* good for making drums. Then quoting the *Shih King* it explains how the sound of drums (逢逢) *peng peng* resembles the call of the *T'o*. This is certainly an example of onomatopœia as anybody who has heard the cry of the Alligator can testify. Indeed we believe that the very name *T'o* is an imitation of the explosive noise made by the Alligator. The word *resounded* would be a far better translation than the *rolled harmoniously* of Dr. Legge's. Whatever might be the idea of Chinese commentators about music it is difficult to find much harmony in the noise generated by striking a huge drum with a mallet. The Chinese had observed the similarity of the two sounds as the *Po Wu Chih* (博物志) (4) quoted by the *Kang Hi's* dictionary, says: "The *T'o* is ten feet long; it makes a noise like a drum." *Cheng Chi* (藏器) considers the cry of the *T'o* as far from harmonious, indeed he says, it is very terrible. "It cries (at night) at each watch (5); thence the phrases: strike the watches *T'o keng*, beat the drums *T'o ku*." (See *Pen Tsao Kang Mu*).

The Great Materia Medica (本草綱目 *Pen Tsao Kang Mu* (6) being a scientific work will probably give us a better description than any dictionary. It gives 鼉龍 *T'o* dragon, 鮀魚 *T'o* fish and 土龍 earth dragon as synonyms. It says: "The nature of the *T'o* resembles that of the dragon. It measures 10 feet in length and belongs not to the family of fishes but to the family of dragons." According to *Li Shih-chen* the character 鼉 is an old graphic representation of the head, body, feet and tail of the animal. The oldest form of this character we find figured like this 鼉 in Morrison's Dictionary. It is composed of the two characters 單 *tan* alone and 黽 *min* a frog. According to the *Po Wu Chih* the *T'o* 鼉 is a land dragon and the *T'o* 鮀 a fish."

The author *Cheng Chi* (藏器) quoted by the *Pen Tsao* says that the *T'o* is of a *sleepy nature, often closing its eyes.* It is

(4) Written in the latter part of the 3rd century.

(5) These watches were struck every two hours with a drum, now a gong or a hollow bamboo is used.

(6) Written by Li Shih-chen under the Ming dynasty.

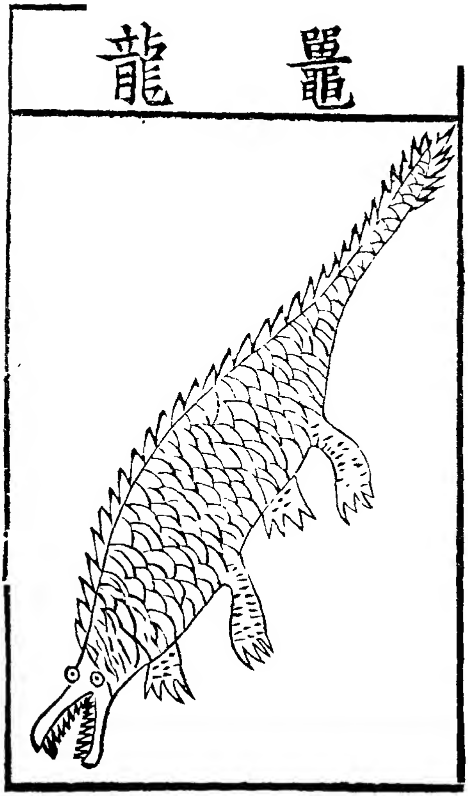
gifted with *great strength* and can *burrow in the banks of rivers. Sung* (頌) writing under the Ming dynasty says that they are *extremely numerous in the lakes and rivers.* According to this author it resembles the Gecko and the Pangolin (*Manis pentadactyla?*) but measures from ten to twenty feet in length, its back and tail are covered with an armour (甲). It cries at night and the mariners are much afraid of it. *Li Shih chen* says that its burrow is very deep. The sailors catch it with a rope made of bamboo, at the end of which is an iron hook baited with flesh. The animal, having swallowed it, is pulled out of its hole little by little. It can move to either side, but cannot jump. It lays a considerable number of eggs, sometimes as many as a hundred, but it often devours them. The people of the south are very fond of its flesh and serve it (as a delicacy) in every marriage feast. *Lu Tien* (陸佃) pretends that the flesh of the body is as good as that of cattle, but that of the tail is unwholesome.

The Kuang records of *Kuo Yi Kung* (郭義恭) say that the fish *T'o* is three feet in length, and about one in height. Besides four feet it has a tail resembling that of the *Yen-ting* (蝘蜓) (*Lacerta muralis* or *Chamæleon*) but much longer. It is the custom of the people of the south to eat the flesh of the *T'o* when they celebrate a marriage ceremony.

A little further it is related that at the time the Emperor *Wei Wu* (魏武) was returning from Hupeh into Honan a *T'o* was found underground by a man who was digging in the fields.

Here we find the measurements a great deal more accurate (though perhaps the exaggeration is the other way) as the Alligator actually living in China is from five to six feet long. The height given is sufficiently accurate and the comparison with the lizard leaves no doubt concerning the nature of the *T'o*.

With the exception of the sentence concerning the flesh of the tail, all the description given by the Pen tsao and the Kuang records agrees wonderfully with all that we know of the nature and habits of the Alligators of the Mississippi and Guyana, as described by Audubon, Whatterton and Bosc. Even the way of catching the animal is similar, only the Indians use an iron chain fastened to a tree as a substitute for the bamboo rope. Indeed we cannot doubt the identity of the *T'o* with the Alligator when we consider the somewhat quaint but sufficiently characteristic picture which illustrates the text of the Pen tsao. As may be seen by this reproduction of it.



We have here the head of a crocodilian pretty well brought out. In the Japanese edition of the *Shih King* a figure of a Gangetic gavial is given for the *T'o* but it is very curious to notice that the artist represents it as being in a glass jar ! (7)

After examination of the testimony given by the Chinese dictionaries, commentaries and scientific works we come to the conclusion that the *T'o* must be an Alligator.

Let us now see what the foreign dictionaries say on the subject.

One of the oldest, Gonçalvez, translates *T'o* : Crocodilo. De Guignes, who is now said to have copied B. de Glemona gives 鼉 *T'o* a crocodile and 蛟 *Chiao* a crocodile.

(7) Probably as he had seen it in some museum.

Morrison, whose dictionary is anterior to Legge's classics, gives the following description, evidently translated from native works: 鼉 *T'o* a large *sea* (?) animal, upwards of ten feet long, a species of fish, its skin was formerly used to make *large drums* (8). 鼉龍 *T'o Lung*; an animal resembling an *Alligator.*

Medhurst's dictionary printed at Parapattan, Batavia, in 1843, translates the *Kang Hi Tsze Tien* and gives: A species of Guana or Iguana, about ten feet long. In this he evidently trusts his imagination as we have already proved that it cannot be that animal.

Finally, the best of all Chinese-Foreign dictionaries, Dr. W. William's work gives 鼉 *T'o* "A large triton, gavial, or water-lizard, found to the South of China." Then he translates the Imperial Dictionary (the *Kang Hi Tsze Tien*) and far from finding the melody of the sacred drums harmonious he translates the famous quotation of the *Shih King* by the less poetical but far more sensible phrase: "The bass roar of the drums" in which by the way *T'o* is not translated at all.

So much for the character *T'o* and its meaning, but this old ideographic sign is not the only one by which the crocodile or Alligator is designated in Chinese books.

If we search the *Tai-ping Yü-lan* (9) for this character 鰐, (10) we find a long chapter headed:

鰐魚 *Ngo yü.*—The fish *Ngo.*

Quoting the "Chronicles of Foreign Countries under the Wu Dynasty (222-277 A.D.)," (11) it says:—The fish *Ngo* measures from twenty to thirty feet in length, it has four feet, and resembles the warden of the palace (守宮 a poetical name for the Gecko), and can swallow a man. Speaking of those found in the kingdom of *Lin Yi* (林邑 Southern Cochin-China), it says in shape they look like the *T'o*. They have four feet and their jaws, which are six or seven feet long, possess, on each side, teeth as sharp as daggers. They devour every deer, stag, or even man they can get hold of. According to the encyclopedia of *Yü Hsi* (虞喜志林) Alligators are found in the south, their jaws are eight feet long. They are very terrible in

(8) Said to breathe a vapour from its mouth, which forms a cloud and cause rain.

(9) 太平御覽卷九百三十八.

(10) Formed from 魚 a fish and 噩 frightening abbreviated 咢.

(11) 吳時外國傳.

autumn. When they see men on a ship's side they raise their heads above the water, seize and devour the mariners, who, in consequence always provide themselves with spears for defence.

The *P'o Wu Chih* (博物志), description of all productions, says that they are found in the Canton district and resemble the tortoise. If the head is cut, and the teeth knocked out, they will grow again, as many as three times. We find the same description and measurements, as quoted above, in the records of the curiosities of *Kuang-chou* (province of Kuang-tung), but the story of the teeth growing again is more sensibly told, "If the teeth are knocked out, they can grow again in the space of ten days."

The book called "*Lin Piao Lu Yi*" (嶺表錄異) is the only one that gives the colour of the body, an earthy yellow. It also compares it to the gecko, but says it is more rapid in its movements. All pretend that men and animals fear it equally. It seizes deer and tigers when crossing the water and tears them to pieces.

All these characters are common to the 鼍, and as we will yet demonstrate later on, the animal described under the four characters—鼍, 鱷, 鰐, 鮀 is the Alligator. 鼍 being the oldest form of the character 鱷, which by the way is not found in the classics; and 鰐 or 鮀 are the common forms of character now used. Gonçalvez translates: 鱷 and 鰐 *Crocodilo*, and 鮀 by *Caçäo*. De Guignes gives *Crocodilus* as signification of the first and second character, and *quidam piscis* for the third. Morrison has: 鱷=鰐 or 鰐魚, a large fish of the lizard species which lurks by the shore and devours men and animals; the Alligator.

In Medhurst's dictionary we find:—

鰐 *Go.*—The Alligator or Crocodile. They are found in the South seas of China(12). The natives say that after the head has been cut off and dried, if the teeth are knocked out, they will appear again three times in succession. The Alligator is about twenty feet long with four legs, and a head three feet in length, with a very pointed nose. It has tiger's teeth, and can bite in two large stags, that attempt to cross the water. *Han Wen-kung* (韓文公) published an essay to drive the Alligators from

(12) This is probably a misconstruction of the Chinese 南海 which stands also for 南海縣 Nan-hai-hsien, the district of Canton, as it is well-known that Alligators do not live in sea-water.

the coast of Canton, and the natives say those beasts have not been seen there since.

鱷 *Go.*—An Alligator described as having the form of a fish, with a dragon's neck, tiger's claws, crab's eyes, turtle scales, a tail several feet long, and very rugged along the spine. It abounds on the banks of rivers, where it frequently takes off men and animals. Medhurst then quotes *Han Wen-kung.*—All this is evidently translated from native works.

鮀 *Tho.*—Another account says that it is found near the banks of *lakes*, where it burrows in the mud; its form is like a lizard upwards of ten feet long, and its back and tail are covered with scales.

Evidently the Alligator again (same article in Morrison's dictionary).

Morrison's dictionary explains this last character 蛟 *Keaou* to mean:—A kind of *Crocodile, found in the Yang Tsze Kiang*, said to weigh two thousand catties, etc., as above. Gonçalvez calls it also: *esp. de Crocodilo.*

In Dr. William's dictionary we find:—

鱷.—From 魚 *yü fish* and 噩 *ngo alarming*, as the phonetic. The crocodile and the Gangetic gavial; the former is said to have existed at one time in the River Han, near Swatow, whence they were exorcised in the Tang dynasty; metaphorically rapacious cruel, for example: 鱷紳劣吏朋比爲奸.

"The rapacious gentry and unscrupulous underlings make a worthy union of rascals."

鱷魚 *Ngo yü*: an *Alligator*, cayman, or crocodile; it seems to be sometimes wrongly applied to fresh water dolphins."

Also written 鰐 *Ngo* from *yü* fish and *ngo*, 咢 to startle, to strike the drum at intervals of singing. This reminds us of use of the skin of the animal.

According to Dr. William's 鮀 *T'o* would be a species of bullhead which burrows in the mud, and he gives:—

蛟 *Chiao.*—"The dragon of thickets and morasses, which *has scales, but no horn;* the description size and figure correspond very nearly to the fossil *Iguanodon*, and possibly a large kind of *Salamandra* or *Amblyrinchus* was at first intended." To this, we can say, that an *Iguanodon* with scales and without horn looks very much like a crocodile poorly drawn; besides the *Iguanadon* belongs to the inferior cretaceous formation which as far as we know has not yet been found in China.

We have indeed seen large collections of fossil teeth in the medicine shops of Shanghai and we have a pretty good num-

ber in the R. A. S. museum, still the very characteristic tooth of the Iguanodon has never been met with.

The crocodile being larger than the Alligator we understand the differences of weight and measurements given by Chinese authors, putting aside some misstatements or wrong descriptions. The crocodile being more ferocious than the sleepy and harmless Alligator we understand also why they used to capture the latter and kill the former.

It is also evident from all these native descriptions that the Chinese had heard of, and some of their travellers to India probably had seen the Gangetic gavial and crocodile, hence their conflicting statements. Even in Europe unscientific people often confound the crocodile with the Alligator more vulgarly known as cayman, the name given to it by the Indians and negroes in America.

As a *resumé* and conclusion of this philological discussion which we now bring to a close, having Chinese dictionaries and encyclopedias in one hand; old records, natural history and Chinese and Foreign dictionaries in the other I propose to translate 鼉 *T'o* by Alligator as well as 鱷 or its abreviated form 鰐.

蛟龍 will mean the crocodile or the gavial class of animals. The classical quotation of the Doctrine of the Mean:

黿, 鼉, 蛟龍, 魚鱉生焉 *Yuan, t'o, chiao lung, yü pieh sheng yen* I should translate:

"The great tortoise, the Alligator, the crocodile, the fish and the turtle are produced in the water."

The phrase of the *Shih-King*:

鼉鼓逢逢 *T'o ku peng peng*, should be understood as: "the alligator-skin drums $\frac{\text{are}}{\text{were}}$ resounding," and these words of the *Li-Ki*:

季秋之月伐蛟取鼉

would mean: "About the time of the ninth moon they kill the crocodile and capture the Alligator."

II.—HISTORY AND LEGENDS.

In the works of *Han Wen-kung* 韓文公(13) also called *Han yü* 韓愈, a celebrated statesman and poet who lived under the

(13) 韓文公詩增註.

dynasty of the Tang (A. D. 768-924) we find this. When *Han yu* was banished and sent to fill the post of governor in the semi-barbarous region of *Chao chou* (潮 州) in the modern province of *Kuang-tung* (廣 東), he enquired of the people as to the state of the country and the miseries of the inhabitants. They answered him that at a place in the east of the city there was a small lake or marsh not far from *Chao yang hsien* (潮 陽 縣) (14) called the "*Chiu* waters" (秋 水). It was full of *Ngo fishes* 鰐 魚 hatched from eggs and some ten to twenty feet long, which devoured the cattle and other domestic animals, thus gradually exterminating them to the consequent impoverishment of the people. A few days after *Han-yu* went to this place and calling his officer *Chin chi* ordered him to have a pig and a sheep thrown to the *Ngo* fishes which he then addressed as follows:—

Under former rulers you have been allowed to remain here, but under the reign of our virtuous emperor you cannot be tolerated and you must leave his empire. How could you be permitted to live here in peace when you are molesting the people fattening on their domestic animals and increasing daily in number? I have come to rule this country in the name of the sovereign and as I am myself much afraid of you we must part company. At the south of this place is an immense sea in which fishes as large as whales as well as those as small as shrimps and sprats can live in peace. You can easily go there in a day but I give you from three to seven days to go. If after that period you are still found here I shall be compelled to bring with me some good archers with strong bows and poisoned arrows and declare against you a merciless war.

In the afternoon of that very day a violent wind arose accompanied by thunder and lightning. The storm raged for a few days driving the waters sixty *li* eastwards leaving the lake perfectly dry. Since this the *Ngo fishes* have disappeared and the people of *Chao chou* live in peace.

On the native maps of the province of Canton we find still to the west of *Ho Yuan hsien* (河 源 縣) 110 miles west of *Chao chou* a small lake called 鱷 湖 *Ngo hu*, *i.e.* Alligators' lake.

This story we have also found slightly abridged in the Annals of the province of *Kuang-tung* (廣 東 通 志).

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(14) Opposite Swatow.

According to Mr. W. F. Mayers(15) this is simply a legend symbolizing the efforts made by *Han Yü* in civilizing the rude inhabitants of the country. But it was during the reigns of the Tang, far from the mythological times, and this story agrees with what we know of Alligators, and as they are still found in the province of Canton, as this paper will show before concluding we think it quite possible that they were really in existence there, and then, and even before. Indeed, the *Ngo* are mentioned in the "Annals of Foreign Countries during the Wu" (222-277 A. D.) where we find them sufficiently well described to leave no doubt of their crocodilian nature. The book of the Liang dynasty (502-556 A. D.) says that in the kingdom of *Lin Yi* (林邑) now southern Cochin-China, crocodiles (*Ngo*) are reared in the moats of the capital as well as in the enclosure where, outside the gates of the city, the wild beasts are kept. Criminals are thrown to them. If during three days they are left unharmed by the animals, they are considered innocent and restored to liberty. These crocodiles measure twenty or more feet in length and resemble the *T'o* (Alligator). There is no mistake possible here, as crocodiles are still found abundantly in Siam. They belong to a variety only known there, thence their name *Crocodilus Siamensis.* The Chinese book adds that they are very ferocious and that they are also found in *Tsang Wu* (蒼梧) (southern Kuangsi ?) as well as in foreign countries.

The "Annals of Foreign Countries" (222-277 A.D.) also narrates that the King of *Fu Nan* (扶南) by name *Fan Ch'un* (范尋) had crocodiles (*Ngo*) brought to him and kept them in a pond. Rebels and criminals were thrown to them and released as innocent if left unharmed by these saurians. The kingdom of *Fu Nan* is probably Tonquin where crocodiles are still found.

In the Annals of Annam (交州 *Chiao chou*) we find that crocodiles like to come out from the waters on to the sand where they lay eggs about the size of those of a goose and good to eat. They seize tigers, deer and stags when they cross the water, tear them to pieces and devour them. They even attack man now and then. If their teeth are knocked out they will grow again in the space of ten days.

We now come to China proper. In old times, says the book called *Ling Piao Lu Yi* (嶺表錄異), a military mandarin (called 李 in the *Kuang-tung* Annals) was coming to *Chao chou* (潮州). As his boat was passing the Alligators rapid (鱷魚灘)

(15) The Chinese Readers' Manual article Han yu.

it struck on a rock and was wrecked. All the accumulated treasures of this officer, his books, vases, pictures and maps were lost in the deep. He called his mariners and ordered them to dive in order to recover them if possible. But these men saw so many Alligators under water that they did not dare to rescue the lost treasures, believing that they had come to the private residence of the monsters. So it is not only Han Yü who saw Alligators near Chao chou.

The Canton province is not the only one mentioned as producing the *T'o* or *Ngo*. In the chapter headed Imperial audiences (王會) of the *Shi Chia Chou Shu* (汲家周書) that is: Discoveries made in tombs, we find that the people of Hang chou fu in Chekiang send the *T'o* as a tribute to the Emperor, to make the court drums with the skin, as the commentator explains.

With this we will close our quotations from Chinese history and give a few of the legends concerning the crocodiles or Alligators.

The Chinese have an idea that the Alligator is wonderfully tenacious of life. The Canton annals say that the head can be cut and dried, before the animal dies, the muzzle can be broken into pieces and all the teeth pulled out and still it lives.

The history of the Wu dynasty tells us that in the first year of the reign of *Sun Liang* (孫亮) white barking Alligators or crocodiles were found in *Kung An* (公安). It is a common belief there that when the *T'o* barks and the back of the tortoise becomes flat, a dreadful calamity is surely impending from which people can only save themselves by fleeing to *Nan Chun* (南郡), now the city of *Nan Cheng* in Kiangsi. And indeed in the second year of *Sun Liang* a rebellion arose in *Kung An* and a mandarin called *Ch'u Ko-ch'üeh* (諸葛恪) was defeated by the rebels; his younger brother *Ch'u Ko-jung* (諸葛融) mandarin in *Kung An* was taken prisoner by them. His seal of office was made of gold cast in the shape of a tortoise. In his grief he scraped the back of the tortoise and swallowed the gold so obtained, which gold caused his death.

The book of *Chuang Tsze* (莊子) says that as Confucius was visiting the bridge of *Lu Liang* (in Shantung) the water rose twenty-four *chang* and rushed with great impetuosity over thirty *li* of country. The *Yuan* 黿 and the *T'o* 鼉 did not dare

to risk themselves in the waters but the sage saw a man swimming across some hundred *pu* (about a mile). When he came out Confucius asked him how he had managed. The man answered: "my nature does not fear, my destiny is certain I will follow the strength of the waters. It was because I had no fear that I succeeded in crossing the waters, I really had no other means."

In the *Ch'un Chiu* of *Lü Shih* (呂氏春秋) we read that the emperor *Ch'üang Hsü* (顓頊) ordered *Fei Lung* (飛龍) to make a musical instrument of eight sounds (a kind of mouth organ) for the ceremonies of the cult of *Shang Ti*. When this instrument was used for the first time a *T'o* which was near the place kept measure with the melody by striking his tail against his body.

The records of *So Shen* (搜神記) narrate that in Honan a man named *Chang Fu* (張福), being one night in his boat, saw a woman coming in a small canoe. When she came near him she said: "When night comes in I dare not go out as I fear the tiger." *Chang Fu* at first laughs at her then he invites her to come and spend the night with him on his boat. About midnight as the moon was rising in the sky, *Chang Fu* (waking) saw a white *T'o* sleeping on his arm instead of the woman. Greatly afraid he rose up and the animal fled, the man saw then that what he had taken for a small boat was simply an old wooden log.

In the book on foreign countries written by the Buddhist priest *Cheh Seng* (支僧) we find that in the kingdom of 私訶條 (*Ssu Ho Tiao*) on the mountain called *Ch'uan Tao Leao* (全道遼) is the temple of *Pi Ho Lo* (毗訶羅); there a stone figure of a *T'o* is adored. This image is said to possess a supernatural power and when provisions are scarce at the monastery the priests address to it their prayers and their stores are soon replenished.

The records of *Hsü Shih* (許氏志怪) narrate the following story: A Buddhist priest, by name *Yao*, being a sorcerer and an exorcist was once called in (the city of) *Kuang Lin* to exorcise a woman named *Wang* who was possessed. Upon entering her house *Yao* knew that she was possessed by the spirit of a *T'o*, so he scolded this spirit insulting it and asking it why it had entered the body of that woman. *Wang* answered "a man wants to kill my husband." The devil who was near her answered: "I am exceedingly sad for I know that to-day I must die." It wept and moaned. To this *Yao* said "I know

it is a spirit and cannot fight with it." The neighbours heard these words and then saw a *T'o* coming out, it was killed by *Yao.*

In the book called *Yu Min Lou* (幽明錄) we find the following legend:—

At the time of the emperor *Yung Chou* of the Sung dynasty a mandarin named *Chang Chun* (張春) being in office (*Che-fu*) at *Wu Chang* (武昌) in Hupeh was marrying his daughter. Just as she was getting into her carriage she went mad and on the road struck every man she met declaring she would not marry. A countryman, who was a sorcerer, saw the young lady and understood her to be possessed by the spirit of the tortoise (魅邪). He said that he could cure her by taking her to the bank of a river and there beating a drum. *Chang Chun* having heard of this believed that the man was an impostor (was lying) so he ordered him to bring the tortoise (*Kuei.*) A green snake came first and was transfixed with a nail by the sorcerer. Towards midday a great tortoise was seen issuing from the waters, the sorcerer taking a vermilion pencil traced on its back a mystic character and ordered the animal to return to the waters. At evening time a large white *T'o* was seen in the middle of the river rising and plunging as the tortoise pursued it. The *T'o* died, the damsel wept bitterly on what she called the death of her husband and little by little she returned to her senses. As people were questioning which of the three animals had caused the sickness of the lady the sorcerer said: "The green snake was the messenger who informed me, the turtle is a lover and the *T'o* was the husband of the woman." He then brought the three animals to *Chang Chun* who saw that he had not been false (made a lie.)

In the *Pen Tsao* we find that it requires just the same number of men to pull a *T'o* out of its hole as would be needed to dig it out; otherwise it is impossible to capture it. When it cries the country people know that rain is coming. The same book gives a rather curious method of killing and flaying the Alligator. The mode is as follows: pour boiling water down its throat; after a certain time (rather long I fear) it will die then you can peel off the skin.

Of course such a curious animal akin to the dragon must be used in the materia medica of the Chinese. The scales are found in most of the druggist shops under the name of *Lin Yü Chia* (鱗魚甲). It is mostly procured in the district of Canton where according to the *Pen Tsao* it can always be found.

These scales are said to be sour, slightly warm and a little poisonous, though this last is denied by some authors. They are supposed to cure heart and intestinal diseases, fever and female disorders, diseases arising from fear, nose bleeding, tooth ache and they are also used as a vermifuge and as a remedy for goitre and skin diseases.

The recipe is as follows: roast the flesh, pouring wine over it, burn the skin and bones to ashes and mix them with warm wine. The scales are good to make a soup which is said to cure madness. The fat and liver are also used as medicines in different diseases.

The Chinese have a wonderful idea of the length of time an Alligator can live. Indeed they use it as a term of comparison for old age and if we say as old as Methuselah they write: (a friend of mine informed me) "older than the *T'o*" *pi t'o lao* 比鼉老. They also believe that this animal is gifted with greater strength and vitality than any of the known animals, the elephant included and as a Chinaman jocosely remarked to me: "if you foreigners give nine lives to the cat we must give at least twelve to the *T'o*."

III.—FOREIGN LITERATURE.

Having now well-nigh exhausted the Chinese literature on the subject of the *T'o* and *Ngo* let us investigate what foreign books on China can say on the subject of Crocodiles or Alligators in this country.

Thanks to the kindness of the Jesuit Fathers who placed their valuable library at Sicawei at my entire disposal, and even provided me with written copies of the Great Imperial Encyclopedia quoted above, I was able to consult all the works written on China by their eminent predecessors at the Court of *Kang-Hi*.

The valuable collection of books on China found in the library of the North-China Branch of the Royal Asiatic Society was also carefully consulted.

It is curious enough to notice that out of such a considerable number of works written on this country four or five only, and those in the first part of the 17th century speak of the Crocodile or Alligator. And yet, after a careful comparison of the texts, they are found to copy each other so that the original sources of information are reduced to two, namely:—

Marco Polo the Venetian who writes in the 13th century, and evidently speaks from hearsay, and Father M. Martini who no doubt got his information from Chinese works.

I was much surprised to find nothing on this subject in Duhalde, Grosier, and others who seemed to have described everything worthy of note in the Empire. It was also in vain that we consulted, the more modern works on this country. Even those pretending to give the natural history of China are silent on the subject of crocodilians.

In Wells Williams' Middle Kingdom we find:—The larger lizards have not been noticed in China, though the Crocodile is found both in India and Siam on nearly the same latitude as Kuangtung. It may, however, have inhabited once the rivers of the Middle Kingdom, for the character *Ngoh* is evidently an original word, and Marco Polo describes a huge serpent which he had not seen himself, but which seems to have been intended for the Crocodile.

Here is the text of the Venetian traveller. Marco Polo (1280), Vol. II, p. 62 and seq., speaking of Province of Carajan, the actual province of Yunnan, says: "In this province are found snakes and great serpents of such vast size as to strike fear into those who see them, and so hideous that the very account of them must excite the wonder of those who hear it. I will tell you how long and big they are."

"You may be assured that some of them are ten paces in length, some are more and some less. And in bulk they are equal to a great cask, for the bigger ones are about ten palms in girth. They have two forelegs near the head, but for foot nothing but a claw like the claw of a hawk or that of a lion. The head is very big, and the eyes are bigger than a great loaf of bread. The mouth is large enough to swallow a whole man, and is garnished with great (pointed) teeth. And in short they are so fierce-looking and so hideously ugly, that every man and beast must stand in fear and trembling of them. There are also smaller ones such as of eight paces long, and of five, and of one pace only. The way in which they are caught is this: You must know that by day they live underground because of the great heat, and in the night they go out to feed and devour every animal they can catch. They go also to drink at the rivers and lakes and springs. And their weight is so great that when they travel in search of food or drink, as they do by night, the tail makes a great furrow in the soil as if a full ton of liquor had been dragged along. Now the huntsmen who go after them take them by a certain gyn which they

set in the track over which the serpent has past, knowing that the beast will come back the same way. They plant a stake deep in the ground and fix on the head of this a sharp blade of steel made like a razor or a lance-point, and then they cover the whole with sand so that the serpent cannot see it. Indeed the huntsmen plant several such stakes and blades on the track. On coming to the spot the beast strikes against the iron blade with such force that it enters his breast and rives him up to the navel, so that he dies on the spot (and the crows seeing the brute dead begin to caw, and then the huntsmen know that the serpent is dead and come in search of him.")

"This then is the way these beasts are taken. Those who take them proceed to extract the gall from the inside, and this sells at a great price; for you must know it furnishes the material for a most precious medicine. Thus if a person is bitten by a mad dog, they give him but a small pennyweight of this medicine to drink, he is cured in a moment. Again if a woman is hard in labour they give her just such another dose and she is delivered at once. Yet again if one has any disease like the itch, or it may be worse, and applies a small quantity of this gall he shall speedily be cured. So you see why it sells at such a high price. They also sell the flesh of this serpent, for it is excellent eating, and the people are very fond of it. And when these serpents are very hungry, sometimes they will seek out the lairs of lions or bears or other large wild beasts and devour their cubs, without the sire and dam being able to prevent it. Indeed if they catch the big ones themselves they devour them too; they can make no resistance."

As Col. Yule remarks: "It cannot be doubted that Marco Polo's serpents here are crocodiles (or Alligators) in spite of his strange mistakes about their having only two feet and one claw on each, and his imperfect knowledge of their aquatic habits. He may have seen only a mutilated specimen. But there is no mistaking the hideous ferocity of the countenance, and the "eyes bigger than a fourpenny loaf" as Ramusio has it. Though the actual *eye* of the crocodile does not bear this comparison, the prominent *orbits* do, especially in the case of the *ghariyal* (gavial) of the Ganges, and form one of the most repulsive features of the reptiles' physiognomy...And there is some foundation for what our author says of the animals' habits, for the crocodile does some times frequent holes at a distance from water, of which a striking instance is within my own recollection (in which the deep furrowed track also was a notable circumstance.")

"The Cochin-Chinese are very found of crocodiles' flesh and there is or was a regular export of this dainty for their use from Camboja, I have known it eaten by certain classes in India. The term *serpent* is applied by many old writers to crocodiles and the like, *e.g.* by Odoric, and perhaps allusively by Shakspeare (*Where's my serpent of old Nile.*")

"Matthioli says the *gall of the crocodile surpasses all medicines* for the removal of pustules and the like from the eyes. Vincent of Beauvais mentions the same, besides many other medical uses of the reptiles' carcase, including a very unsavoury cosmetic."

For the French text of Marco Polo we consulted, "*Le livre de Marco Polo par M. G. Pauthier*, chapter cxviii, page 393." There we find in a note that Klaproth (in his "Nouveau Journal Asiatique Février 1828, page 118,") is of opinion that the animal in question is a boa, a kind of snake he says common in Yunnan. He ought to say a python, instead of a boa, as we have now at the Shanghai museum skins from this immense snake sent from Yunnan. But we think it more probable that the Venetian traveller mixes the python and Alligator in his somewhat obscure statements. H. Murray quoting Marco Polo in his Historical and Descriptive Account of China adds a few lines to explain that the animals in question are evidently *crocodiles*.

If we also compare the description of Marco Polo with those given by Bosc and Audubon of the Alligators of America, we will find many points of similarity. According to these authors, the Alligators, which are found as far north as the thirty-second degree of latitude, bury themselves in deep burrows, in the banks of the rivers where they pass the *whole of the cold season*, and even *the entire day in summer*. They fall into a lethargic state before the setting in of the frost and their sleep is so profound that they may be almost cut to pieces without manifesting any sign of life. They seldom travel except *during the night*. They can fast long, live on frogs, fish, aquatic birds, *on dogs, hogs, cattle,* and *any animal they can catch*. Slow on land they can move with great velocity in the water. Though usually met with on the edges of the rivers they are sometimes *also found in ponds in woods*. The Indians *eat the tail* only, and their eggs are prized by the natives, though they partake of the musky smell of the animal, which when strong is insupportable, but it is not perceptible when they are in the water. So disinclined are they to attack the human race that Mr. Audubon, and his companions have waded waist deep amongst

hundreds of them. They are caught with a strong hook baited with a bird or a small quadruped, and connected to a tree by a chain. They avoid the salt-water and proximity to the sea. When angry or fighting they swell themselves and utter a dull bellowing sound not unlike a blacksmith bellows. Stones or concretions are often found in their stomachs. They generally lay from fifty to sixty eggs which they deposit in the sand. In *Alligator palpebrosus*, the eyebrows form large knobs of the size of a man's fist (the great loaf of bread of Marco Polo).

After Marco Polo the oldest work in which we find a mention of the crocodiles in China is the Atlas Sinensis of M. Martini Amstelodam, 1656. In the description of the city of *Gucheu* of the province of *Quangsi* we find: "Ad urbis "ortum est lacus parvus Go, in quo olim Rex *Pegao* decem aluit crocodilos, quibus, ut devorarentur objicere solebat "reos et sceleratos; ab iis innocentes nunquam læsos fuisse "narrant, adeo que, quos crocodili non occiderent, liberi eo "ipso, tanquam vacantes omni culpa abire jubebantur."

That is to say: "At the entrance of the city there is a small lake called *Go* (crocodile lake) in which the King *Pegao* used to keep ten crocodiles. It was the custom to give them the accused people and the criminals to devour.

It is said that the innocent were never hurt by them, so that those who were not killed by the crocodiles were free from this very fact and ordered to go as if they were entirely innocent."

These saurians did not appear to be so good criminal judges in the province of Kuang-tung as the same author describing the city of Chingkiang (in the district of Chaochou) says:

"Ad ortum urbis Ço amnis est, quem incolunt crocodili "etiam hic hominibus infesti." *i.e.* At the entrance of the city is (found) the river Ço inhabited by crocodiles, which are a great plague to the people.

In the description of the Province of Huquang, P. M. Martini speaking of the city of Siang Yang, says:

"Siang flumen ad urbis Barrolybicum est, in quo animal nascitur equo non absimile nisi quod squammosum sit, & ungues ut tigris habeat, ferox est, quod et homines et animalia cœtera aggrediatur id præcipue autumni tempore tentat, quo frequentius ex aquis egressum terram pervagatur. (Novus Atlas Sinensis a Martini Martinio versus 1654. 7a. Provincia p. 76)."

This we find copied by Serlinus in a very curious old book printed at Francfort on the Mein (1165) and called "Artificia

hominum miranda naturæ in Sina et Europa. Willelmus Serlinus & Georgius Figwich. Caput XVI p. 1188. But as it was the custom at that time the authority is not quoted and the latin is cramped or badly copied. Leaving altogether the Barrolybicum he writes only Siang flumen alit animal, etc., and *ungues* is badly enough transformed in *angues* which has no meaning.

The following sentence of M. Martini: "At Chaocheu (Provincia Kuangtung) in amne Go incolunt crocodili etiam hic hominibus infesti" is also copied by Serlinus, but he puts *degunt* instead of *incolunt* thinking it probably a more elegant latin. This statement of Martini is confirmed on his map where we find the river Go flowing near Chao cheu.

Father Athanase Kircher, in his "China Illustrata, Amstelodam 1667," prefers to copy the description of these animals from Marco Polo.

Then comes the book "L'Ambassade de la Compagnie Orientale des Provinces Unies vers l'Empereur de la Chine, etc. . . . Leyde 1665." This is the description he gives, in quaint old French, of the Crocodile.

"On trouve aussi force *Crocodiles* près la ville de *Chao cheu* (province de Quantung) dans les eaux du fleuve de *Co* (Go ?) les quels molestent et tüent beaucoup de monde.(16) Cet animal a cinq choses fort considerables ; il devient le plus grand du plus petit principe et commencement, *maximus existit ex minimo*, parce qu'il est produit d'un œuf ; il remue la maschoire d'en-haut ayant la basse immobile ; il croit tout le temps de sa vie ; il n'a point de langue selon plusieurs, ou l'a courte, ou inutile selon d'autres ; et il fuit devant les personnes qui le poursuivent, ne courant qu'après celles qui témoignent de la peur en s'éloignant de luy. . . . . On dit qu'il peut vivre quatre mois sans manger. . . . . . Les *brebis* et les hommes font ses plus friands morceaux. . . . . On le prend avec des hameçons attachés au bout d'une corde fort deliée faite de *cannes*, en mettant quelque mechante brebis ou chèvre pour amorce que ces monstres avalent comme une pillule, et ainsi ils se trouvent attrapés.

"Les Chinois et les autres peuples Orientaux font bonne chère de leur chair qui est blanche, d'un gout de chapon et d'une odeur très agréable. Ils tiennent que l'eau, dans laquelle cette chair aura boüillie, a la force de guérir les morsures des araignées, et que leur sang eclaircit la veue, et remedie aux

(16) This is evidently taken from Martini.

blessures des couleuvres. Leur peau estant brulée et mêlée avec de la lie d'huile engourdit les membres de telle sorte qu'ils ne sentent point la piqure."

This description is also accompanied with a curious engraving intended to represent a crocodile, but it is evidently drawn a great deal more from imagination than from nature. The body which is covered with oval scales, very distant from each other, does not rest on the ground and the tail has only one ridge of scales instead of two.

From these times 1280 and 1667 we find no books mentioning the existence of the crocodiles in China except Williams in his Middle Kingdom as above quoted and Morrison who says positively in his dictionary that crocodiles are found in Yang-tsze-kiang. We have searched carefully the old files of the Shanghai newspapers and it was not until the year 1869 that we found the first reliable modern notice on the existence of crocodiles in China.

Under the title *Crocodiles in China*, the *Shanghai Evening Courier* of the 17th of March 1869 gives the following:—

"A little time ago, before the rise in opium and the feverish but profitable speculation in rags to arrive, engrossed the active foreign mind of Shanghai, we were interested in a report that a real true dragon had been imported and was to be seen by the curious in the Shanghai tea gardens. Naturally reports magnified the appearance and attributes of this extraordinary creature; nothing of the kind had been seen before; it had come out of a cave in the wild *Kiangse* mountains; could devour a child without distressing its thorax; and was eminently calculated to perform that supreme act of Chinese patriotism: exterminate the barbarian. A goodly crowd of foreigners went to see the monster. Armed with ten cent pieces or whatever small coins the ingenuity of bank compradores induces us to accept as quarter dollars, and unmindful of sundry bad cases of confluent small-pox and other forms of infectious disease with which the entrance to the Chung wang miao (17) is ornamented, we found ourselves amidst the wonders of that most curious ground known as the tea gardens. Passing through the festive crowd who were spending their loose cash with mountebanks, peep shows, story tellers, and sweetmeat vendors, we came upon a large space surrounded by a strong net in the middle of which was a canvas screen about two feet in length, and behind this was concealed the dragon. A notice at the entrance informed the public that he weighed so

(17) Temple of Chung Wang.

many catties and was a real horrible mountain dragon. Above the canvas screen could be seen the manly form of a coolie armed with a bamboo, who every five minutes appeared to be engaged in a kind of Pootung outrage (fight) with the monster within, and every five minutes by the gesticulations and cries of this gentleman it would appear that the dragon had got the better of his antagonist, who disappeared defeated behind the canvas for a time before recommencing the performance. Truly there must be a "pucka" (proper) demon inside! so feeing the attendant, in we went, with a fore knowledge that we were going to be "done" and "done" we were. In an ordinary washing tub about three feet long was to be seen a poor miserable half dead common Crocodile, or Alligator as learned discriminators of species declare it, who resembled his congener of the Nile about as much as a monkey does a man. He had a curious despairing look in his wicked little eye and seemed to be thinking of that feed of fish which he sadly wanted, but would never get. The attendant, he of the bamboo lately engaged in the terrific struggle, took the wretched thing from his tub, turned him upside down, opened his mouth in the gentle way a parish doctor does a pauper's, shewed his teeth, and with a broad grin informed us that he was very terrific. Then the poor beast was returned to his wash tub and instantly went into a stupor! It had most likely come up in a ship from Siam, the crew of which forgot to feed it, and was not comparable as an object of interest to our late friend the salamander. That brute at all events redeemed a long life of the most uncompromising indolence, by turning sharp round on his master and biting his hand severely causing him at once to respect his captive and be more careful in future. The party assembled, among whom were the learned both in law, language, medicine and science felt that they had come a long way to see nothing, but to console themselves, agreed that this wretched little crocodile having thirty-two teeth must be a new species, and that consequently both time and coin were well spent."

This is the first mention of a *probable new kind* of Alligator or crocodile in China and though the article was written in jest some of the scientific men who were with the writer (Mr. Goodwin, an able scholar and great ægyptologue) declared from their cursory investigation that this was a new species as we will see later on by Mr. Swinhoe's note in the Proceedings of the Zoological Society.

This paper was written and going to the press when hearing that Mr. E. A. Reynolds had seen Alligators in the Yang-

tsze long before that I enquired from him on the subject, and he very kindly favoured me with the following note:—

"In April 1853, I lent my house-boat to T. T. Meadows, H.B.M.'s Consul, and accompanied him in her to Nanking, where we were towed by H.M.'s steamer *Hermes*, having on board Sir Sam. Geo. Bonham, Governor of Hongkong. On approaching Silver Island, we noticed what appeared to be human bodies floating near the shore in the eddy tide; but on nearing there were found to be wooden idols, which the rebels had thrown into the river from the joss-houses on the Island. Not seeing anyone moving about Meadows and myself proceeded in my boat and landed. We found all the pavilion, priests' dwellings, etc., burnt down; but all the temples at the landing were perfect. I found one priest, to whom I asked, if there were no small josses about, he took me to a ditch into which a number of brass, bronze, and other metal idols had been thrown. I carried away quite a number. He took me to a pond or a small lake, taking a small bowl of rice and a switch with him, with the latter he beat the water crying 'ado, ado,' presently an Alligator or Crocodile came towards here we were standing, and while still in the water opened his mouth into which the priest threw the contents of the bowl: the Alligator backing himself into the water again. I was quite unprepared for such a sight, and was a little alarmed at first. I should say the animal was of a good size, but as his open mouth only came out of the water, I could not see how long it really was."

"Returning to the temple, I noticed a very fine etching, of an Alligator, also a long inscription cut in the slate tablet, I dug this out intending to bring it away, but on getting it to the ground it was found it would require several men to carry it off, so I had to abandon it. I, however, think it would have been replaced by the priests, and may be now in the wall, from whence I removed it. I should think one could get a full description of this Alligator from the inscription.

"The officers of the *Hermes*, who landed shortly after were much struck with the correctness of the etching, being a departure from Chinese rude pictures of all animals. Doubtless this correctness may be attributable to the fact of the priests having daily opportunities of watching their pet when basking in the sun.

"A friend of mine, Captain Elsworthy, who was in the Taoutai's fleet blockading the river, told me he had frequently been shewn this same Alligator by the priest some months after; and they told him it went away in the winter (more likely only

buried itself deep in the mud at the bottom of the pond), and returned in the spring and remained on the Island during the hot months.

"I since made enquiries about this Alligator, and was told that one of the captains of a Portuguese lorcha, employed also in blockading the river, had fired at it with his rifle while the animal was in the pond; but whether he killed it or not, I did not learn; probably not, or else, we would have heard more of it.

"Three years ago (1876), while ascending the Yangtsze in my steamer, being some miles below Nanking, my people were alarmed at a strange to them looking fish, which was close to the shore not more than ten feet from the steamer. I immediately ran to the side, and then saw an Alligator about eight feet long floundering in the wash caused by the paddle-wheels. I stopped the steamer with the view of capturing it, but it had disappeared. I am led to believe this same Alligator was since seen at Chinkiang, no doubt having drifted down by the current."

Highly interested by this communication I took the earliest opportunity of repairing to Chinkiang, and on the 2nd of January 1879 I found in the *Hai Shen Miao*, Temple of the Spirit of the Sea, at the eastern extremity of Silver Island, the tablet in question. It is a heavy marble slab, six feet in height by two in breadth, standing against a wall and bearing in two vertical lines the following inscription:—

江南河道總督長白麟公放鼉處

道光十六年歲次丙申六月穀旦

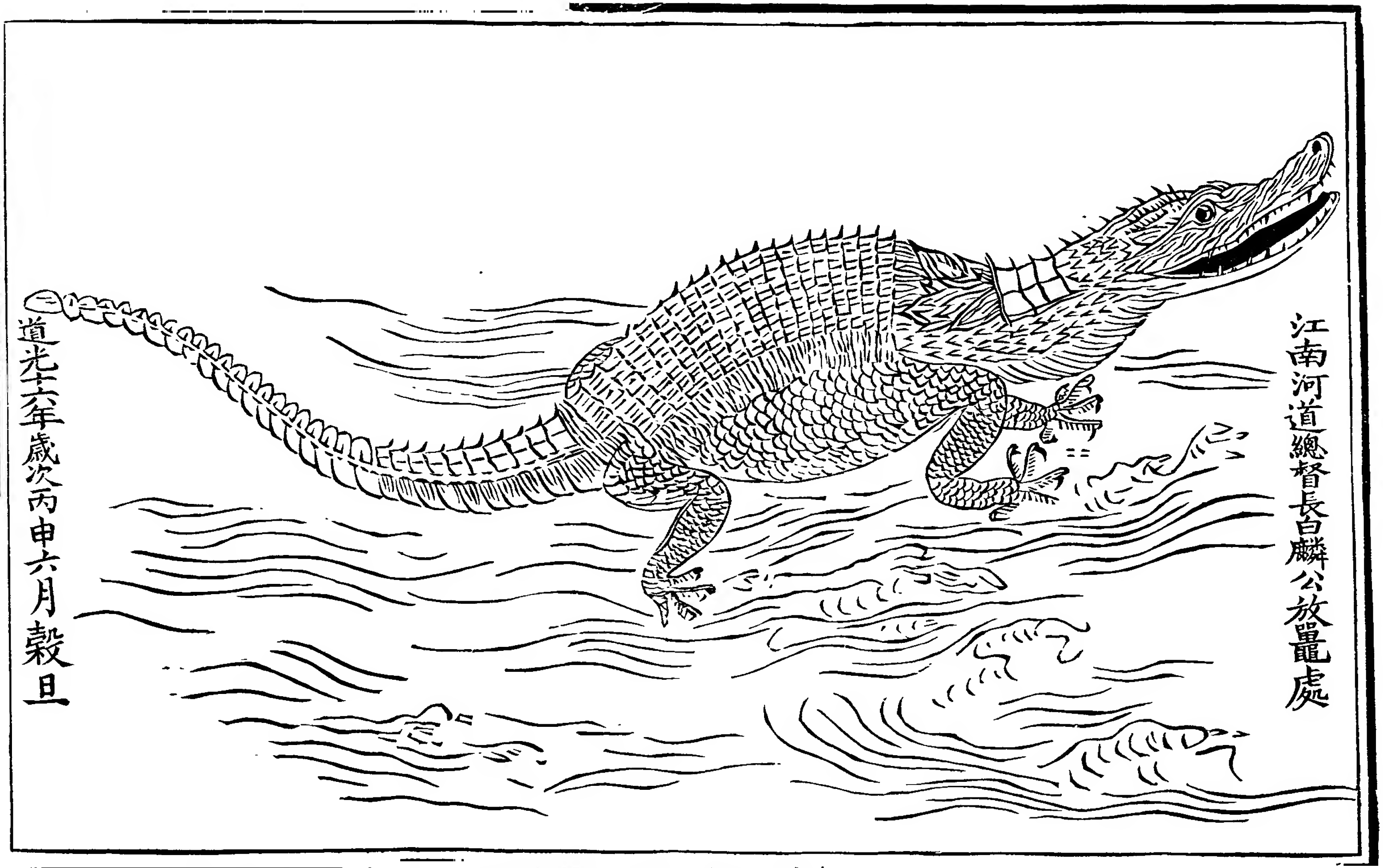

FIGURE OF THE T'O FOUND ON A STONE TABLET IN SILVER ISLAND, CHINKIANG.

That is to say: "*Lin* of *Chang Pai*,(18) Governor-General of the Yellow River of Kiangnan released the Alligator at this place on a lucky day of the 6th moon of the 16th year of *Tao-Kuang* (July 1836). Below the inscription is a very good engraving of the *T'o* Alligator, of which the accompanying woodcut is a reduced facsimile. It was obtained by a direct impression or rubbing(19) made on the stone. A little further on I saw the pond in which a living Alligator is still kept; this specimen has been there for two years. But as it was lying torpid in the mud at the bottom I was unable to catch a glimpse of it.

From the priests I heard that these saurians are often found in the Yangtsze by the native fishermen in whose nets they become entangled. As they are no use to them they are killed by blows on the head and their carcases are thrown back into the stream. Sometimes however they are presented to or purchased by the priests of the *Hai Shen Miao*, where for years past one at least has been kept in the pond. According to my informants at Chinkiang these Alligators come from the Tung Ting and Po Yang lakes being driven in the swift stream of the Yangtsze at flood times.

From the above inscription we understand that the Alligator released from captivity by *Lin* was probably the first seen there. It is a common practice amongst Buddhists to buy living animals and set them at liberty. This is held as a very

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(18) There were formerly two high functionaries superintending the course of the Yellow River, one for the southern course in the old province of Kiangnan (now Nganhui and Kiangsu) and one for the northern course in the province of Shantung; thence the two names of *Kiang Nan Ho Tao Tsung Tu* 江南河道總督 and *Tung Ho Tao Tsung Tu* 東河道總督. (*Ho* 河 is often employed in Chinese language as meaning the river *par excellence* the 黃河 Yellow River).

Chang Pai 長白 stands for *Chang Pai Shan*, the name of a celebrated mountain in the north-east of Manchuria, not far from the northern frontier of Corea. Here it must be translated by the adjective Manchurian, as it appears that the whole of Manchuria is often designated by the name of the mountain, a practice often resorted to in Chinese literature.

The governor general Lin of Manchuria must have been the last but one of the functionaries in charge of the meridional course of the Yellow River, as this charge has been since abolished, most probably on account of the change of direction which took place in the course of this river in 1851. (For this information I am indebted to the kindness of my friend Mr. J. de Bielke, interpreter of the French Consulate.)

(19) To obtain those rubbings a thin paper slightly wet is applied on the stone and pressed into the cuts, a cake of black wax is then rubbed upon it and the characters on drawings appear in white on a black ground.

meritorious act and according to one of the Buddhistic rules its value is enhanced by the comparative rarity of the animal.

On the Yangtsze, this ceremony, called *Fang-sheng* releasing the living, is often resorted to in order to propitiate the god of the waters. Turtles are often bought for this purpose and liberated in the great river with a small piece of metal, fastened to the shell, bearing the date with the name of the pious performer.

In the case of the *T'o*, the Governor-General of the Yellow River wanted evidently to commemorate the event of releasing such a rare animal which he most likely had seen then for the first time; accordingly he chose a lucky day for this performance and caused the commemorative tablet to be erected.

It now stands under the guardianship of some Hunan braves as a part of the temple has been transformed into a fortress, foreign guns having taken the place of the wooden images which floated down the river in 1853 to the great amusement of the rebels.

IV.—NATURAL HISTORY.

If we now consult the modern scientific works written on the Natural History of China, still very few, we find that no scientific traveller, nor naturalist has found the crocodile or Alligator in this country. In the Expedition du Meikong which crossed Yunnan, I expected to find something on this subject, but was sorely disappointed. The Abbé David confines himself to geology and birds describing also some new kinds of Mammalia, but of crocodiles he does not even mention the name. The Novara Expedition round the globe which mentions some of the Shanghai new birds did not go far enough into the interior. Baron von Richtoffen confines himself to geology. The Jesuit naturalist, Father Heudes, has made a name for himself in the conchology of China, but it is curious enough that in dredging for shells in the rivers of Chinkiang and Ningko fu districts he never came upon an Alligator, though, he tells me, he has often heard of the existence of what he calls crocodiles in these districts, where, he says, the natives use them for medicine. Once he lost a good opportunity through the saving propensities of his servants, who refused to buy a skin of this animal because the merchant wanted a few hundred cash more than they thought proper to give.

Thinking that some navy doctor, a temporary resident in China, might have per chance discovered these animals and reported upon them, I searched the Proceedings of or the Zoological Society of London and the Nouvelles Annales du Museum de Paris. I found some new species of crocodiles described in the former, but none were of China. At last, I came upon a list of Reptilians and Batrachians collected in various parts of China by the late Mr. Swinhoe and with great interest read the following :—

"No. 3.—*Crocodilus sp.* ?

"In February, 1869, some Chinese were exhibiting, in the native city of Shanghai, what they called a dragon, which they declared had been dug out of a hole in the province of Shense (Mr. Goodwin puts Kiangse). It was a young crocodile about four feet long, which they kept in tepid water. They made so much money by showing it that they refused to sell it. *I cannot, of course, guess at its species; but I, nevertheless, think the fact worth recording, as evidence that a species of this group does occur in China.*"

Having heard that some two or three years ago a crocodile had been seen in Chinkiang, I asked our President, Mr. T. W. Kingsmill, to write to the person who had seen it for information and this is the reply of Mr. T. W. Duff :—

"In 1875 there was an Alligator caught in the Yangtsze, off the British Concession at Chinkiang, but well out in midstream. It was not particularly lively, although summer time, but this may have arisen from the rough handling it got while being caught. No one could account for its presence in the river, although it was surmised that it might have escaped from some temple; but as there are few of these places near Chinkiang at all likely to have such an animal in them, I do not think it at all reasonable.

"It lived some days in a pond until a deputation of Chinese purchased it for fifteen dollars and presented it to the priests on Silver Island. Whether it lived there or what became of it after this I am unable to say."

Having failed to procure it for the Shanghai Museum an Australian Crocodile brought from Australia to Chinkiang in 1868 by the celebrated entomologist, Dr. Martin (who died in America this year), was sent instead to the Museum, where it was gazed at, for a few years, as a Chinese crocodile until the perpetrator good naturedly confessed his joke.

Nothing more was heard of the crocodiles until April this

year, when a member of the Chinese Customs service, Mr. Lloyd E. Palm, Acting Deputy Commissioner at Wuhu, bought from the natives, a specimen which had been apparently dug from the ground in the neighbourhood. When it reached us on the 15th of April, it was still in its torpid state, and could be handled easily without danger. Having no books of reference in the Shanghai Museum, I took the animal with me to the Jesuits' Museum at Sicawei, and there with the assistance of the curator, Father C. Rathouis, M.D., of Paris, studied and dissected the animal comparing it carefully with the plates of Cuvier, Duméril and other works on reptiles, especially those of India. The skin was then prepared and mounted by our native taxidermist of the Shanghai Museum where it can now be seen. From this study we came to the conclusion that it was probably a new species of Alligator, and I took care to state the fact in the *North-China Daily News* of the ninth of May,(20) when acknowledging the contributions of the preceding month. I added a few words asking for another specimen to be forwarded to Paris, in order to have this species named.

This appeal was duly responded to on the 3rd of October last, when we received a second specimen from Chinkiang. It appears that it had been seen coming down the stream in a half torpid or exhausted state, and some Chinese fished it up just opposite the Custom House.

The capture, made without difficulty, was witnessed by the two Customs employés, Messrs. C. W. de Ste. Croix and J. C. Günther, who conjointly bought it on the spot and presented it to the Shanghai Museum, where it arrived on the 4th of October, and where it is still alive in a state of lethargy having only eaten twice since its arrival.(21)

I now had well-substantiated cases before me. In the first some of the mud in which the Alligator had been buried could

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(20) The museum has also received two new and important specimens:— A beautiful Albatross (*Diomedea Derogata?*), shot by Capt. A. Croad near the Chusan Group; and a living Alligator (*Alligator Lucius?*) sent by Mr. J. L. E. Palm from Wuhu, where it was captured in the hills. Père Heudes having also seen Alligators near Ning-ko-fu, there is no more doubt about the existence of this saurian in the Yangtsze waters. It differs considerably from the two species described in Cuvier and Duméril, and will likely prove a new variety. If any friend of science can succeed in sending us another live specimen, it will be forwarded to Paris for examination.

A. A. Fauvel, *Hony. Curator.*

(21) It died on the 24th of December, apparently from aneurism of the heart, as the pericardium was found full of blood. It was an adult female, with sixteen unmature eggs in the ovaries.

be still found in the mouth and anal aperture, so it must have been found not far from Wuhu, and the capture of the second specimen in the Yangtsze waters proves that these two Alligators were natives of China. About September I saw two live specimens, which Dr. O. F. von Mollendorf, the interpreter of the German Consulate at Tientsin, had bought in the Chinese city of Shanghai for the sum of ten dollars a piece. The weather being then warm, they were very lively and rather dangerous to handle, uttering, when approached their characteristic bellowing sound. The natives who sold them said they had come from the Poyang lake where they were to be found in numbers.

Upon inquiry I soon learned that some had been shown from time to time in the native city, and Dr. Little told me he saw two in Chefoo this summer, where they were exhibited as a great curiosity. They measured about five feet in length. Finally, I myself lately procured in the Chinese city of Shanghai, a skin with the complete skull attached.

One was also procured in the same place by Mr. Loczi, the geologist of the Austro-Hungarian scientific mission. I was then able to study the generic characters from four good specimens and from this study I came to the conclusion that we were in the presence of a real Alligator of a new species or at least not described in Cuvier, Duméril, Bibron or other authors I could consult. Unhappily as I was unable to find here the last work of Professor Vogt of Geneva on the crocodilians I cannot be quite sure that this species has has not been found elsewhere.

However the article on Alligators in the very last edition of the Encyclopedia Britannica clearly states that all the species of Alligators known are found in America and with one exception only (The *A. Lucius* found up to the 32° lat. in the Mississippi) are confined to its tropical parts Brazil, Guyannas, etc.

Cuvier, says the same Encyclopedia in a former edition thinks it most probable that Alligators have their representatives in our hemisphere although it does not seem to be yet ascertained whether any true Caimans are found in the old world. This is perhaps a little far fetched as the words of Cuvier are "Il serait possible que l'on découvrit par la suite dans l'ancien continent quelque espece appartenant à la subdivision des Caimans."

It is probably with still less accuracy that the same edition of the Encyclopedia says, speaking of *Crocodilus Biporcatus* the same as *C. Porosus*: "This species is the common croco-

dile of India and its archipelago, frequènting the Ganges and other great rivers which empty themselves into the ocean, as also those of Corea (?) and China (?), Ceylon, Java, Timor, etc."

Upon what authority this statement is based the Encyclopedia Britannica does not say. Though real crocodiles may be one day found in Southern China I have great doubt about the possibility of their being discovered in cold Corea. At all events I never saw this last country mentioned for its crocodiles elsewhere.

Thinking that our Alligator might have its representative in Annam and Cochin-China I went to see some of our French missionaries who had lived many years in these countries and from their descriptions made sure that the crocodilians found there are the *Crocodilus Siamensis C. Porosus* and the gavial of India. They saw our specimens in the Museum and declared them entirely new to them. I insist upon this point, because of the crocodiles in Saigon being called caimans, a name which belongs only to the Alligator.

The flesh of the Alligator does not now seem to be eaten in China as that of the crocodiles is in Annam, but its skin is found in medicine shops where it is often used in place of a sign board. Two were procured in the native city of Shanghai and the natives who sold them told us they came from Canton. All the natives here called these skins sea dragons' skins *Hai Lung p'i*, and seemed considerably astonished when I told them that the Alligator was never found in the sea. In other districts, Chinkiang and Wuhu, the name for it is *Ngo Yü* or *T'u Lung*, *Ngo* fish or earth dragon.

With this I shall close my disquisition on the history of the Alligator and shall now proceed to the description of the animal.

V.—DESCRIPTION OF THE ALLIGATOR.

As a great many people easily confound the Alligator with the Crocodile we will give first the generic characteristics of the two from Cuvier's book. "Les Ossements Fossiles." 1.—Crocodile. Muzzle oblong; the upper jaw has a notch on each side to allow the fourth tooth of the lower jaw to pass, the hind feet are fully webbed and fringed or denticulated on the outer margin. The teeth are at least 15 on each side in the lower jaw and 19 in the upper one. The first ones of the

inferior jaw perforate the upper one at a certain age and the nuchal plates as well as the dorsal differ greatly in number, shape and position from those of the Alligator. The post-orbital holes are very large and always present.

2.—Caïman or Alligator (the names are synonyms. Caiman being the one given by the negroes in America to the *A. Lucius.*) The muzzle is broad and short. The superior jaw receives the fourth tooth of the lower jaw in a particular hole or foramen which conceals it entirely; the hind feet are only semi-palmated and do not possess the fringe or denticulations. The length of the head is to its breadth as two to one. The teeth are very unequal in length and there are at least 19 and sometimes as many as 22 on each side of the lower jaw; at least 19 and often 20 on each side of the upper jaw. The post-orbital holes, in the species which possess them, are very small, in one species they are entirely absent. There are about 6 species of Alligators known. Cuvier describes three with one variety viz: *Alligator Lucius, A. Sclerops, A. Palpebrosus* 1st variety and 2nd variety. Since Cuvier's book was written two more have been added to the list: *A. Cynocephalus* and *A. Nigropunctatus.*

I will now compare the Chinese Alligator carefully with the five described by Cuvier and with the two others as described by Duméril and Bibron.

At first glance it looks very much like the *A. Lucius,* the pike-muzzled Alligator. Its head and muzzle are flat, the sides nearly parallel and uniting in front in a parabolical curve. The internal edges of the orbits are slightly elevated. The nasal aperture is, even in the young, divided in two by a bony bridge. A small hole in the bones of the palate corresponds to the nasal aperture but it is covered by skin in the living animal.

All these characteristics also belong to the pike-headed Alligator but it differs in this way that the snout of the *Lucius* is comparatively longer. Its length is as 1 and ¼ to its breadth taken in front of the orbits. The total length of the cranium (taken from the base of the skull to the point of the snout) is as 2 and ⅓ to its breadth taken at the same place. In our Chinese Alligator, the length of the snout is nearly equal to its breadth and the length of the cranium is a little less than twice the extent of the snout, so that the head forms an isosceles triangle shorter than the one figured by the head of the *Lucius.*

A greater difference exists in the appearance of the bones which are deeply honey-combed or vermiculated in ours and

smooth in the other, whose snout is also more flat. Other differences exist in the shape and direction of the post-orbital holes. Their external aperture is ovalo-elliptical with the great axis sensibly parallel to the axis of the skull; in the Lucius they are smaller, the perforation being a small one at the bottom of an elliptical *fossa* whose great diameter forms an angle with the axis of the head; the aperture of the angle being in front towards the snout.

The vermiculated appearance of the bones is also possessed by the *crania* of the *A Sclerops* and *A. Palpebrosus*, but the shape of the head is far different and the post-orbital holes very small in the first are altogether absent in the second.

Nor does it possess the characteristic crest between the orbits which gives its name to the *Sclerops*, *i.e.* spectacled.

But it is very curious to notice that however different the shape of the head from the *Palpebrosus* it possesses like it the bony eyelids from which the specific name is derived.

The teeth formula of the Alligators is from 19 to 22 on each side of each jaw (the one for the *Sclerops* is $\frac{19.19}{21.21} = 80$, as well as for the *Palpebrosus*). In our specimens I find $\frac{18.18}{19.19} = 74$, so it has fewer teeth than any species but the *Lucius*, whose formula is $\frac{18.18}{17.17} = 70$.

Thus by the shape of the head, the weavy edges of the snout, the bony bridge of the *nares* (possessed by no other species than the *Lucius*), and by the post-orbital holes it is nea ly allied to the Pike-headed Alligator. By the honey-combed appearance of the bones of the skull and the bony eyelids it approaches the *A. Palpebrosus*.

By the shape, form and number of the teeth it differs from all as well as by the size and general dimensions of the different parts of the body.

But those are not the only specific characters of the Alligators and we must now look to the disposition, form and number of the nuchal and dorsal plates, and also compare the dimensions of the various species.

The nuchal plates of the *Lucius* are 8 in number, oval-shaped and distant from each other, disposed in 4 rows of 2 each. In the *Sclerops* there are 14 square plates, disposed in five rows and close to each other, being 2 in the 1st, 4th and 5th rows and 4 in the two others. In the *Palpebrosus* we count 10 plates in rows of 2 close to each other, they are separated from the skull by a line of 4 plates of good size and distant from each other. The disposition of the nuchal plates in the *A. Palpe-*

brosus 1st variety is very nearly the same as the one found in our specimens when we see six conspicuous nuchal plates closely packed in three rows with a short space of separation from the plates of the back not found in the other species. Two small round isolated plates are found in front of the nuchal shield and between them and the skull is a semi-circular row of six conical plates. These characteristics I have found constant in the six specimens I have been able to study and constitute by themselves a new species.

The number of the rows of dorsal plates is 17 from the shoulders to the base of the tail, they correspond exactly to the number of vertebræ. They are disposed as follows:—

3 rows of 4 plates
7 ,, ,, 6 ,,
7 ,, ,, 4 ,,
— —
17

In the other species I find the number of rows varying from 18 to 19. The number of the plates in each row is also at—variance with the number of those in our specimens. The difference is still more perceptible in the number of the single or double crested bands of the tail.

The length of our adult Alligator is about 5 feet and 8 inches whilst the *Lucius* measures 6 or 7 feet, some go even to 14. (The head is included about 8 times in the length of the body of the Chinese Alligator).

The *Sclerops* measures from 11 to 14 feet (8 heads ½.) The other species measure from 6 to 9 feet. So our Chinese Alligator seems to be the smallest of all known.

Its colour above is a greenish black, speckled with yellow vermiculated lines only apparent when wet. The underparts are of a greyish colour, on the tail bands of faint yellow and green are visible.

This colouration is also peculiar to the Chinese Alligator. The colour in the other species being: a deep greenish brown above and a white tinged with green in the *Lucius;* or a blueish green above and an irregularly marbled green and yellow below in the *Sclerops.* In both the *A. Cynocephalus* and *A. Nigro-punctatus* the back is greenish with black spots. The hind feet of our specimens are very slightly palmated as may be seen by the plate. In this it resembles *A. Palpebrosus*, the least palmated of all.

In conclusion I find that the Alligator of China differs great-

ly from all the described species; at least from all those described in Cuvier, Dumeril, Bibron, etc. Its position appears to be between the *A. Lucius* and the *A. Palpebrosus*, so until it has been more carefully studied at home, we propose for it the distinctive name of *Alligator Sinensis* and append herewith the final description of it as a base for further and more complete study.

Alligator Sinensis.

Distinctive qualities and habits drawn from six specimens, of which one is a male and one female.

The Chinese Alligator appears to be a small species measuring from 1.45 to 1.74 mètre; though longer specimens may still be found.

General Dimensions.—In the largest specimen studied the measurements are as follows:—

Length of the head (from the snout to the articulation of the jaws)..	0m. 240
Breadth of the head at the same place	0m. 135
Breadth of the head in front of the eyes	0m. 115
Body from base of cranium to the beginning of the tail	0m. 638
Length of the tail..	0m. 863
Total length....	1m. 741

The length of the head is contained about 8 times in the length of the body, and it is double its breadth in front of the orbits.

The measurement round the middle of the body gives 50 centimètres.

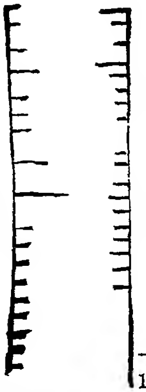
The edges of the snout, which is short and slightly concave are very weavy, a great deal more so than in the *Lucius*. It seems a little broader in the male than in the female.

Teeth.—The formula of the teeth is $\frac{18.18}{19.19}=74$ with sometime a small difference of one or two teeth in either of the jaws. It seems also to change with age as in a young specimen we found the formula to be $\frac{17.17}{18.19}=71$.

These teeth vary much in size. They are, with the exception of the back ones (molars!) sharp pointed with a slight curvature directed inwards. Being symmetrically disposed we will give their respective number and disposition only for half of each jaw, beginning from the snout:—

1st.—Upper Jaw.

Incisive?	2 small teeth.
Sharp and pointed canines?	2 longer ones.
	3 medium size.
	2 large teeth, the 2nd one being the largest of the upper jaw.
Short and rounded molars?	4 small teeth.
	5 medium size.
	18



2nd.—Lower Jaw.

1 long tooth fitting in a deep foramen in the palate.

2 small teeth, fitting each in a small foramen hardly apparent in the bones of the skull.

1 long canine, deep foramen.

7 very small teeth.

3 large teeth (the middle one longest.)

5 large rounded teeth (molars.)

19

All of them overlap those of the lower jaw.

There seem to be at least three generations of teeth, as in the oldest specimen I found smaller teeth always present within the others.

Cranium.—As may be seen from the annexed plate the skull presents the general appearance of an isosceles triangle whose base measured at the articulation of the jaws is contained 1.7 in the length; otherwise the head is very nearly twice its breadth.

Dimensions of the cranium: length from base to snout. The base taken on the line of articulation of the jaws	0m. 234
Breadth at base	0m. 147
Breadth in the middle, just in front of the orbits	0m. 105
Length of snout from this place	0m. 117
Height of the head at the thicker place (behind the eyes) including lower jaw	0m. 105
Total length of the head including the lower jaw	0m. 264

The sides of the snout are nearly parallel to the axis of the cranium, they are joined in front by a parabolical curve beginning at the upper canine tooth at which place it is much enlarged. The snout is concave being enlarged at the nares.

Nares.—The nares are separated from each other not by a bony septum as in the *Lucius*, but simply by a bony bridge. The ridge is slightly elevated and the shape of the opening in the bones of the snout is quite semicircular.

Bones of the Skull.—The bones of the cranium are deeply

honey-combed or vermiculated, in some places perforated as orund the margin of the palate in which there is a small opening immediately under the nares, but it is covered by skin in ihe living animal.(22) There are two large bow-shaped openings tn the back of the palate just under the eyes, they are also covered by the skin of the palate; they measure five centimètres in length and one and a quarter in their greatest width.

Eyes.—The orbits are very near each other, the distance between them being only one centimètre, the inner edges are slightly elevated and there is a marked depression in front of nine millemètres deep, where the ridges slope down on the snout. In the thickness of the upper eyelid are lodged one or two thick bony plates irregular in shape.

Ears.—The tympanum of the ear is simply covered by a thick flap of skin which closes more or less upon it; there is no external vestibulum.

Post Orbital Holes.—They are very apparent ovalo-elliptical in shape and can be felt even through the skin. They are situated immediately behind the orbits and in the same line with them. This line which passes through them according to their grand axis is parallel to the axis of the skull and also passes through the middle of the nasal aperture, so that the post-orbital holes, the bony eyelids and the nares are situated on two lines parallel to each other and to the axis of the cranium.

The line forming the basis of the skull is slightly convex towards the body with a very small notch in the middle.

Under the lower jaw near the throat there is on each side a tubular gland containing a musky substance, when the animal is angry these are projected outwards by a kind of telescopic motion like two horns or tubes about two centimètres in length.

The Chinese Alligator appears very slow in his movements being nearly always in a half torpid state, in the summer time when molested he is inclined to bite but is never first in the attack. For the general colouration of the body see above page 33 and page 32 for the disposition of the nuchal and dorsal plates.

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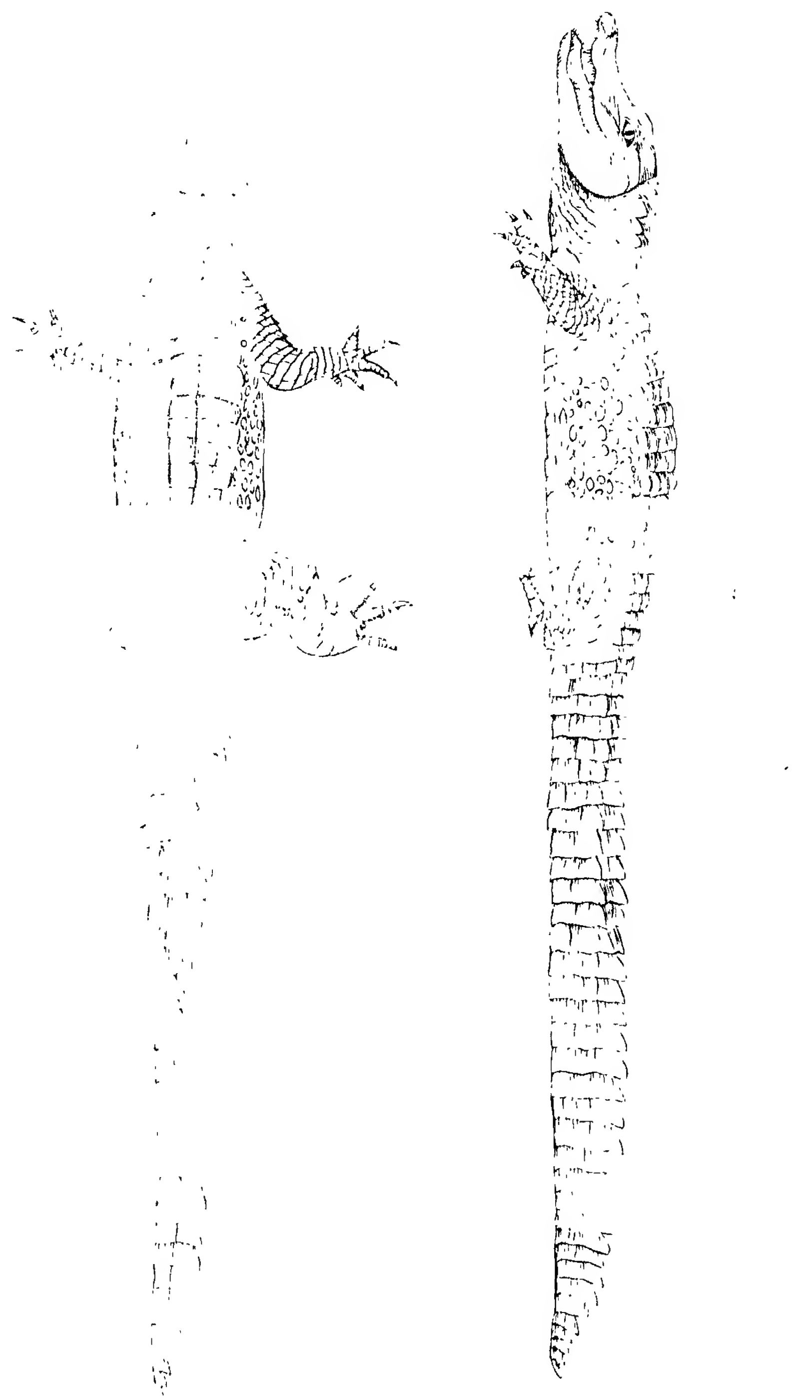
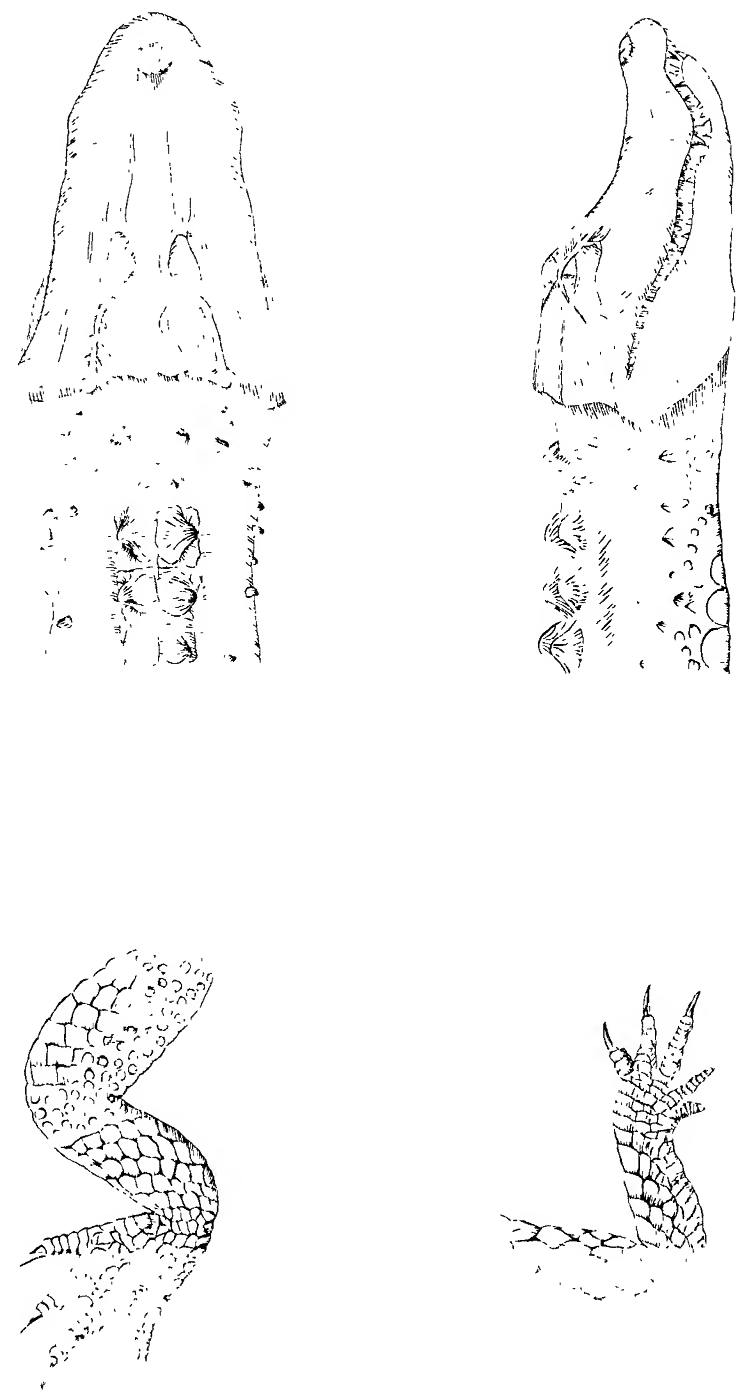
(22) Not always present.



Alligator sinensis



Atelier de la Mission Cathol. de Zi-ka-wei, (Tou sè wè), 1878

After this paper had been printed I found some curious notes about the Alligators in different works and received further valuable information of which the following are the most important items:—

I.—PHILOLOGY AND CHINESE RECORDS.

In the *China Review* of March and April 1879, Vol. VII No. 5 I read among the notes and queries: CROCODILES. 起蛟 "Raise the Crocodile" means "deluges" or "disastrous floods." The question as to what the 蛟 really is has already been discussed of recent date both in this journal and elsewhere. The watery phenomena known as "crocodiles" are said to occur only in the interior Provinces, and to be especially frequent in Honan. The "crocodile" takes several years to incubate, and during this period lies concealed deeply in a gently undulating mound, which is never covered with snow. If, therefore, it is observed that any given spot is not covered with snow when the rest of the ground is covered, notice is taken of the fact, and persons are sent annually to make examination of the spot, and observe if the absence of snow is repeated. If the spot be uncovered during three successive years, the "crocodile" is unmistakably there, and must be dug out. At a great expenditure of time and labour this is accordingly done, and the animal (whose appearance as described answers to that of a small Alligator) is carefully conveyed to the sea. If he is not dug out, when he himself comes forth and "rages," he speeds like a blight all over the land, cutting through every obstacle, and carrying behind him a huge "tidal ware." All this too in the interior!"

This may explain why the natives made such a demonstration at the finding of an Alligator underground some time ago near Chinkiang. The event was commemorated by a small article in one of our local Chinese newspapers, the *Shen Pao* 申報 and the following is the translation published by the *Shanghai Courier* of the 11th March, 1879:—

"A short time ago, a party of workmen were engaged in clearing out a small canal close to Chinkiang, when they came upon an Alligator which had buried itself in the mud, its scales being distinctly visible. They immediately stopped work and reported the matter to the authorities. The mandarins came down to the place in a body and burnt incense to the beast, in the hopes of inducing it to go, which, however, it refused to do. A large number of people came over from Yang-chow to see

the creature. Its appearance is said to presage a great rise in the river this year."

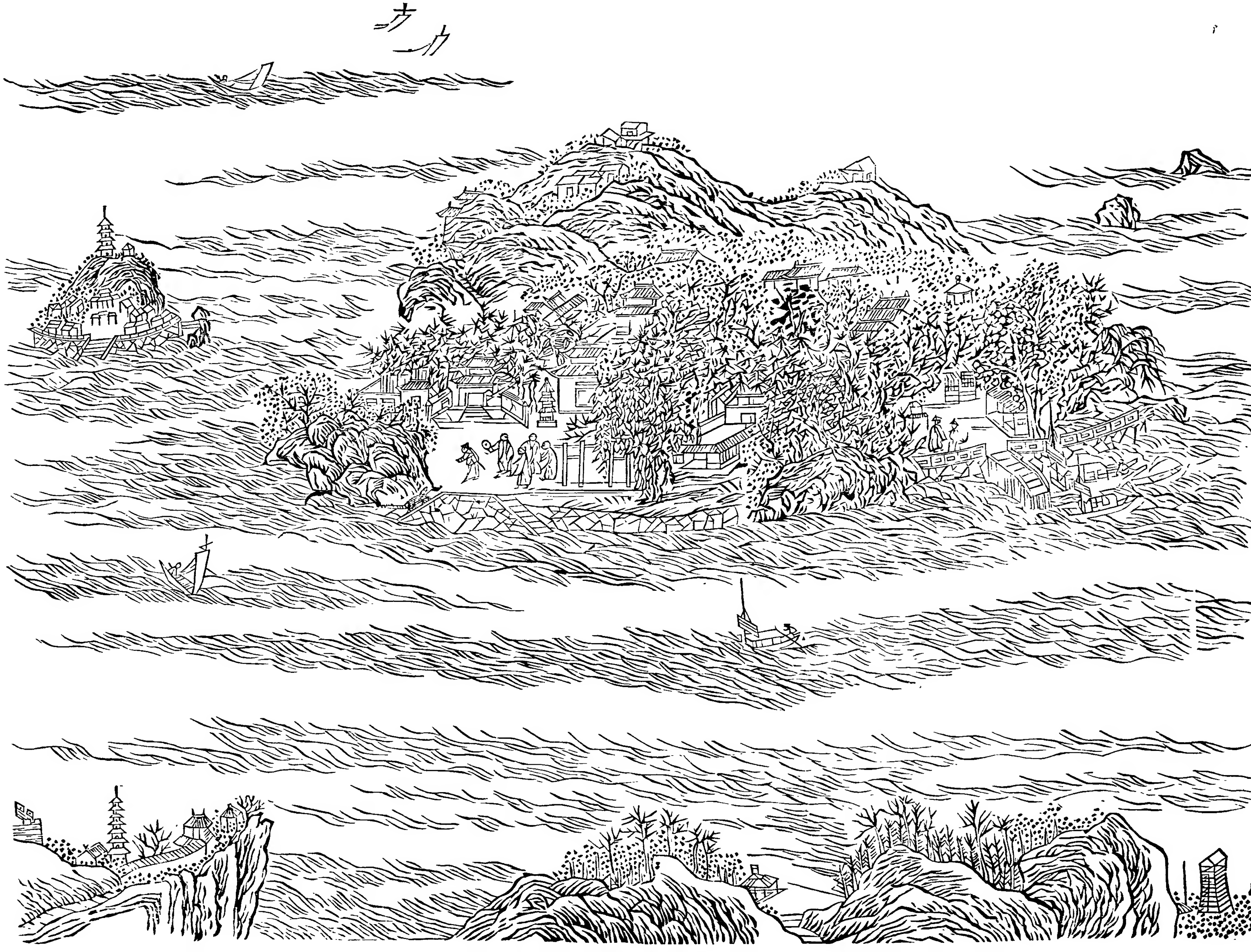
In March 1879 I also found a notice of the T'o in a beautifully printed and illustrated Chinese work called: 鴻雪因緣圖記 *Hung-hsüeh-yin-yuan-tu-chi*, written by Lin, of Chang Pai. This book (2nd edition) was published in the city of *Yang-chou* of the province of *Kiangnan* in 1849 and is the best illustrated Chinese book I know. The work is in six volumes of about one hundred pages each and having a fine double page engraving after every two pages of printed matter. These two pages are an explanation of the picture. In the second volume of this beautiful work we find a picture of Silver Island at Chinkiang of which the opposite wood engraving is a facsimile. The picture and explanatory notes are headed: 焦山放鼉 *Chiao shan fang t'o*, that is: The release of the Alligator at *Chiao-shan*.

After giving the exact position of the Island, explaining its name, etc., the author describes the temples and nunneries—found there, and mentions the name of the great writer of the Ming dynasty who traced the four large characters 海不揚波 now deeply graven on marble slabs at the entrance of the main temple.

Now he comes to the subject and says: When first I received a government appointment, and had to leave the city of Chinkiang, I saw in the neighbourhood, some distance off, a man standing at the door of a tent, beating a drum to attract the attention of the crowd, and inviting the people to come in and admire an extraordinary object. I sent one of my military officers to see what it was and report to me. He returned with a picture of an animal, which I recognised to be the *T'o*. I immediately bought this Alligator for ten taels of silver and conveyed it to Chiao-shan in my assistant's boat. Later on, (at leisure) I gave orders to have it set at liberty in the great River (the Yang-Tsze-Kiang). But as the animal was continually returning to the Island, I had it placed in the pond called 放生池 *Fang sheng chih*; that is:—Pond for the liberation of animals. It seemed delighted with its new place and disappeared (in the mud). I then composed a piece of poetry in its honour and showed it to the Abbot of the monastery. It runs as follows:—

In the vast seas was once an old Alligator. It possessed a square head and four feet like a dragon. Its back was marked like that of an immense tortoise. This animal was evidently of the dragon family. It could fly through the air, the clouds, the mists and fogs. Alas, by an accident it lost its liberty, and

焦山放鼉



became the laughing stock of a little child. Being moved with pity at its miserable condition, I bought it for a thousand cash. I was then making a tour on the great Yang-Tsze-Kiang. Still, I took it with me to the place called *Kua pu.* On the Golden Mountain stands an old monastery, whose numerous buildings and ornamented temples are rendered famous by the tomb of *Tu pu.* Knowing well for a fact, as old records will prove, that the spirit of the brute was that of *King tu,* I resolved at once to have it set at liberty, on the very tomb of the great man whose spirit it possessed. Badly directed, I could not find the place, so I took it with me to the Island of *Chiao shan,* where I deposited it in the midst of the waves. The animal looked at first much pleased and happy; but soon turning its head it swam back to the jetty, now gliding on the waves, now swimming with great vigour. Having placed it again in a small and light boat, I reached the Elephant Hill, on the opposite shore, where I placed it once more in the midst of the waters. From the very moment of its new liberation, towards the Silver Island it directed its way. Some one said that it had been probably weakened and that it could not contend with the mighty stream. Another one explained that the spirit of the man, with which it was possessed, was evidently anxious to go and rest on the hill of the sacred spirits. Although the Buddhist priests pretend to know all things, the head of all of them, the wise and old Abbot could not account for it or give an explanation. I had the brute placed in the pond of liberation, where it soon found shelter in the muddy bottom, feeling happy and at home I have not a doubt. This charitable deed, I performed with great hope of bringing good luck to my future career. And another song was made, rhyming with mine, by two of the Buddhist priests of the sacred shrine. Two learned students from two different places wrote also a long memorial telling of the circumstances. Four other *litterati* from four distinct cities engraved a perfect picture of the Alligator on a large stone tablet on which they also wrote that Mr. *Liu* of *Chang pai* set free the Alligator at this place. This monument can be seen on the bank of the pond.

II.—FOREIGN LITERATURE.

Having also heard from my friend Doctor Bretschneider of Peking that a mention of Caimans as existing in Corea was

made in an old book called "Histoire des naufrages," I searched for it in the libraries at my disposal. I found that a certain Dutchman by name H. Hamel von Gorcum had written a book on Corea under the title:

"Journael van de ongelukige Voyagie von t'Jacht de Sperwer "gedestineert na Tayovan in t'jaar 1653, hoc t'selve Jacht op "t'Quilpaarts Eyland is gestrant: als made een pertinente "beschryvinger der Landen, Provintien, Staten ende Forten "leggende in t'Coningryk Coree. Rotterdam 1668, 4to."

That is: Journal of the unfortunate voyage of the yacht "The Hawk" destined for Formosa, how the same yacht was stranded on Quelpaert Island, with a pertinent description of the countries, provinces, towns and forts in the Kingdom of Corea."

This book, of which a French edition is also known (Paris 1670, 12mo.) I could not find, but I was able to read the French translation in the "Recueil des voyages au Nord, contenant divers Mémoires très utiles au commerce et à la navigation, Amsterdam," Jean Fréderic Bernard, 8 vols. 12mo. 1732 and other dates, which is in the Library of the North-China Branch of the Royal Asiatic Society.

In the fourth volume, pages 310-311, we read:

"Nous n'y avons point vu d'eléfans, mais on y voit des Kaymans ou crocodiles de differente grandeur, qui se tiennent dans les rivières. Leur dos est à l'épreuve du mousquet, mais ils ont la peau fort tendre sous le ventre. Il s'en trouve qui ont dix-huit à vingt aunes de long, la tête large, le groin de pourceau, la gueule fendue jusqu'aux oreilles, l'œil perçant, mais fort petit, les dents blanches et fortes, rangées comme celles d'un peigne. Ils ne remuent en mangeant que la machoire d'en haut. L'epine du dos de cet animal a soixante vertebres, et il a de longues griffes aux pieds, sa queue est aussi longue que le reste de son corps. Ils mangent également la viande, et le poisson, et sont friands de chair humaine: les Corésiens nous ont souvent dit qu'on avait trouvé une fois trois petits enfants dans le ventre de l'un de ces crocodiles." Now this Hamel von Gorcum was a man of some education, being the secretary of the ship. Made prisoner after the wreck of his ship with the fifteen sailors who had not perished (August 1653) he was taken to the mainland of Corea where he was kept in captivity, first in the capital then in the southern districts, and had ample opportunities of studying the country. With seven of his companions he, at last managed to seize a native fishing junk and reached Nagasaki where he found his com-

patriots after a captivity of thirteen years and twenty eight days (1652 to 1666). With the exception of some letters from the Roman Catholic missionaries which can be read in "L'histoire de l'Eglise de Corée par Ch. Dallet, 2 vol., Paris 1874," this is the only reliable description of Corea we possess from foreign sources. I searched through this last book, but could not find any mention of the Caimans amongst the productions of the country therein described.

However, Monseigneur Ridel, the well-known bishop of Corea, who has resided many years in the country and has just escaped for the second time from the prisons of this unhospitable land, tells me that he has often heard the Coreans speak of a huge kind of lizard living in the rivers. It is fond of coming out on the banks to bask in the sun's rays. He has also read of these large saurians in Corean books, but he does not remember that any of his missionaries, of whom five are still in the country, have seen them. Not having his books with him he was unable to give me the Corean names and characters by which these animals are known.

It would be exceedingly interesting to find out what kind of Alligators these are. Judging from the high latitude in which they are found they probably belong to the same species as the one here described. Though they have not yet been found in Japan it is not impossible that they should be discovered there one day, and, if so, it would not be perhaps too wild a theory to suppose that North-Eastern Asia and North-Western America have been connected at some very ancient period. This theory could also be supported on other grounds. For instance, some of our Chinese Unionidæ are also found in Northern America, and some rare birds, plants and animals are also common to both countries.*

III.—NATURAL HISTORY.

In Wallace's "Geographical distribution of animals, 2 vols., London, 1871." Vol. II., page 406 we find :

"Alligatoridæ, 1 genus, 10 species.—The Alligators which are distinguished by having both the large front teeth and the canines fitting into pits of the upper jaw, are confined to the

* Some people even pretend to find an ethnological connection between the Red Indians and the Chinese.

Neotropical and southern part of the Neartic regions from the lower Mississippi and Texas through all tropical America, but they appear to be absent from the Antilles. They are all placed by Gunther in the single genus Alligator."

This book is the latest authority on the subject so we are now sure that up to now Alligators were unknown in the old continent.

Now, one of our Roman Catholic missionaries, Reverend Father Seckinger tells me that Alligators are quite common in his district (Ning kuo fu, Wuhu, Chinkiang). Children play with the young ones and larger specimens are captured in a long and narrow box. They are then killed, and the skin, with head attached, is sold for medicine. The local name for them is *Tu Lung* i.e. Earth Dragon.

In conclusion I may state that the specimen sent to the Paris museum arrived in good order. I have just received a letter from the learned director, Mr. Fremy, who considers the animal as a new and exceedingly interesting species for which the name proposed by me of *Alligator Sinensis* (Chinese Alligator) has been accepted.

ARTICLE II.

PERIODICAL CHANGE OF TERRESTRIAL MAGNETISM.

By F. W. Schulze.

Chapter I.

GLANCING over the contents of Whitaker's Almanack for 1878, my attention was called to the remarks in a short article on Terrestrial Magnetism, "that the dip, like the declination, is subject to secular, and other variations, the true laws of which are not yet understood, etc."

Thinking it possible to give a satisfactory account of these changes, I herewith attempt a modest essay to do so.

According to Miller and Pouillet's, "Lehrbuch der kosmischen Physik," Braunschweig, 1856, the variation in Paris has been Easterly before 1663 decreasing. By Sir James Ross, the latitude of the magnetic North Pole is in the parallel of 70° N.; and bearing in mind, that the magnetic needle (if not deflected by local attraction), points to the magnetic pole, it is only natural to suppose, that prior to 1663, the magnetic North Pole must have been somewhere to the northward and eastward of Paris, moving towards the meridian of Paris probably in the latitude of 70° N. and passed near the meridian of Paris in 1663, in which year the variation was Zero; then the magnetic pole continued its westerly movement until 1814; the variation attained in that year its western maximum of 22° 34′. Since then, the pole continuing its westward motion, the westerly variation at Paris decreasing, until about the year 1965, the pole passes near the meridian of 180°, by the west of Paris, when at the latter place the variation will become Zero, and becoming easterly again afterwards attaining its eastern maximum when the pole passes the meridian of 90°, east of Paris, in about the year 2116; then the eastern variation at Paris will decrease becoming Zero, when the magnetic pole returns to the meridian of Paris, about the year 2267.

For illustration, take a terrestrial globe, and a ball of twine and attach *the end* of the twine to the geographical position of Paris; then place the ball on the same meridian, but on the parallel of 70° N. lat.; in which latitude perform an act of pa-

rallel sailing by means of the ball, to the westward, slacking the twine as required, but keep it sufficiently tight to represent a segment of a great circle; after passing the meridian of 180°, roll in the twine as required, until the ball returns to the meridian of Paris, in 70° N. lat. whence it departed. The direction of the thread has undergone the same variations, that the magnetic meridian of Paris is subject to, on the surface of our earth.

It is true the variation at Paris, would change exactly the same way, if in 1663, the magnetic pole had been in 70° N. lat. and 180° long. (from Paris), shifting in an easterly direction towards the meridian of Paris; but, recollecting that the dip of the needle increases, when we approach a pole, it must be the same thing if the pole approaches us; now the inclination at Paris is decreasing since 1671, the earliest reliable record (given in the above quoted work on cosmic physics) at my command. Therefore the variation pointing to the northward, and westward of Paris as the present position of the magnetic pole, and the dip of the needle indicating it is moving away from Paris, it cannot be in an easterly direction, but must be westerly, at least as long as no valid reason exists, to suppose that the magnetic pole changes its latitude also.

The inclination has probably been decreasing since 1163, when it must have been a maximum (the magnetic pole passing then between the true one, and Paris); it will become a maximum about the year 1965, and then increase again until about the year 2267, when the magnetic pole will return to the meridian of Paris.

The secular variation of the compass shews, that the magnetic pole is moving round the true pole, and the inclination decides, that it must be from east, towards the west; at about the rate of 151 years for the quadrant (from the meridian of Paris in 1663, to 90° west of Paris in 1814), or about 604 years for a complete revolution, or at the yearly rate of about half a degree at a rough estimate.

An inspection of Duperrey's chart of magnetic meridians, shews the irregularity of those curves; therefore the calculations introduced cannot claim to be mathematically exact, the full truth perhaps will only be learned by careful observations, and experience of future centuries.

Now, take again a globe, and construct roughly a movable system of magnetic meridians around it, with a circle equidistant from the magnetic poles, to indicate the magnetic equator; then place the magnetic North Pole on the parallel of 70° N. lat. and move the magnetic pole on that parallel round the true

one, from east towards the west; you will then have a fair representation of the movements of the whole system of magnetic lines, as it really occurs on our earth; a precession of the magnetic equator on the geographical one from east, towards the west, will take place, and a nutation of the magnetic poles round the true ones, in the same direction.

In this chapter we have seen how the secular changes are taking place, in the following one I hope to shew more explicitly the reasons why.

Chapter II.

Since writing the first chapter I have been favoured by the kindness of a friend (to whose valuable assistance I am much obliged in compiling these lines) with a copy of "Magnetism and Deviation," by John Merrifield, LL.D., F.R.A.S., etc., London, 1874, in phich I find on page 15, the following passage:— "Professor Barlow, in his Essay on Magnetic Attraction, says, "all these variations can be accounted for by supposing the "Magnetic Poles to revolve round the terrestrial ones from "West to East, at about 20° from the latter in periods of about "600 years. Sir W. Hamilton gives a contrary direction to the "revolution, and states the period to be 900 or 1,000 years."

I am not astonished that others should have conceived similar ideas to mine, before me. However, Professor Barlow gives a wrong direction of the revolution, and Sir W. Hamilton, allows perhaps too many years for its completion.

Commander W. Walker, R.N., in his book, "The Magnetism of Ships and the Mariner's Compass," London, 1863, page 8, speaking of Columbus, who had discovered the variation of the Compass, writes as follows:—"On his return to Spain his statement, "that the direction of the Compass had varied was not believed.

"Although other Navigators had observed and announced "the variations of their Compasses, the learned of those times "would not admit the fact, they rather choose to charge sea-"men with ignorance, and inaccuracy in their observations, "then admit errors in the principles established by themselves.

"Pedro de Medina, in his Arte de Navigar, 1545, denies the "variation of the Compass; Martin Cortez, in a treatise on "Navigation printed at Sevilla before 1556, treats it as a thing "completely established. So here we see, that a period of 60 "years elapsed from the time of Columbus, observing and re-"porting the variation of the Compass before the truth of its "existence was admitted."

I hope it will require less time, before the truth of what I may be permitted to call "The Rotation Theory" will be admitted.

Mr. Merrifield gives the date of Captain Ross's discovery of the Magnetic North Pole, the year 1830. According to the theory deduced in the preceding chapter the Magnetic Pole must have been in 90° W. of Paris, in 1814. Moving from that year to 1830, at about 35′ 45″ per year nearly, to the Westward, =9° 32′, which would place the Magnetic Pole in 99° 32′ West of Paris, or about 97° 12′ West of Greenwich; Sir James Ross found it 96° 42′ West of Greenwich, half a degree from where I would place it approximately; I consider this the most conclusive proof of the soundness of the basis upon which my theory is founded.

From the same book of Mr. Merrifield's, I see that Capt. E. J. Johnson, R.N., F.R.S., places the maximum (24° 27′) of Western variation in 1815, but Colonel Beaufoy gives 24° 21′, as maximum in 1819, less modern observations, owing to the then still more imperfect instruments, can therefore hardly have been very correct, and calculations based upon them cannot be very reliable; however, they are quite sufficient to establish the principle in question firmly.

And now we will try to investigate the cause of this Magnetic Polar rotation.

Allowing that the thermometer rises one degree (celsius) for every 90—100 feet, towards the centre of the earth, (after Muller and Pouillet, Lehrbuch der kosmischen Physik), "at "a depth of about 10,000 feet water would boil, and at about "20 nautical miles, basalt and iron would melt," but I will be liberal and allow 25 miles below the surface of the earth as the limit, where we would meet a fiery molten mass.

According to "The Border lands of Geology and History" by Thomas W. Kingsmill, Shanghai and London, 1877, by Mr. Mallet's "Physico-chemical Theory," "the earth is now a ball "entirely, or in the main solid, but of high temperature." In the same work Mr. Kingsmill tells us of Sir W. Thomson, "but "although he rejects a fluid nucleus (of the earth) he acknow-"ledges, that the absence from the sea of long period tides is "not easily explained without admitting a considerable degree "of yielding." "If the interior of the earth were liquid and its "crust composed of so rigid a material as steel, and 300 miles "thick, it would yield to the deforming influences of centrifugal "force, and the attraction of the sun and moon, as if it were "India rubber; under such circumstances, as the whole mass "of the earth would be free to move, there could be no flow of

"tides, sea and land yielding equally to external influences."

I will not enter the field against Astronomers and Geologists; I am content to let them fight their own battles; probably the truth lays in the middle: "les extrêmes se touchent;" therefore I will try to steer a pretty clear mid channel course between the Scylla of solid ball, and the Charybdis of fluid nucleus theories.

Presuming at about 25 miles below our earth's surface the heat intense enough to melt all known rocks and metals, I should think it very unlikely, that the limit between solid crust and fluid interior were defined, as if cut off with a knife; I think one would be gradually verging into the other, more or less in the following order:—Outside solid crust about 25 miles; then accumulating solidifying, semi-liquid slake, succeeded by molten fiery mass. Now, let us consider what would be the pressure of such a mass at about 2,000 miles from the surface on a square foot.

Accepting the specific gravity of the earth as five times more than distilled water (according to F. Reich, 5·58. and Baily 5·66), then a column of 2,000 nautical miles = 12,160,000 feet deep × 1 feet × 1 feet of distilled water at 60·5 lbs. per cubic foot, will weigh 735,680,000 lbs.=328,428 tons, multiplied by 5 (specified weight of earth roughly)=1,642,140 tons pressure upon a square foot on the surface of the earth, the same column if placed upon a square foot at 2,000 miles below the surface would probably weigh less—(I am not prepared to say how much)—therefore we will disallow a whole million of tons, and still the enormous weight of 642,140 tons remains; but even then there is such a tremendous pressure upon the square foot, that I believe no molten mass of whatever high temperature could remain liquid under such a stupendous force, but would obtain a state of almost inconceivable density, that steel compared to it would be like cheese.

Late experiments have shewn, that almost all known gases by application of extreme cold, and high pressure can be forced into the liquid aggregate state first, then into the solid state afterwards; and since it is assumed that our whole earth from a gaseous state of high temperature cooled down into its present condition, I cannot be far wrong in representing the nucleus of the earth as possessing indeed an enormous high temperature, but solidified by excessive superincumbent pressure.

These suppositions being accepted as approximately correct, would give us a body of "a considerable degree of yielding," to account for the absence from the sea of long period tides,

and still not so elastic as India rubber, as not to shew any tides of the sea at all.

Allowing under the solid but sufficiently yielding crust of the earth a fiery liquid, with a fiery solid nucleus within, we must allow that the influence of the same heavenly bodies, which cause the tides of the liquids outside the earth (the Ocean) will do the same with the fiery Ocean within; and this daily interior flood wave will cause a retardation of revolution in the interior fluid mass in exactly the same manner, as it does in the Outer Ocean; it causes a westward tendeucy in the former as well as in the latter, and which I must suppose to be too well and generally understood, that I need not enter here into the explanation; because it is not my object to explain things which others have done much better than I can; but to demonstrate if possible the nature, and causes of the magnetic needle's periodical variations.

Admitting this daily retardation of the fluid interior inclusive the solid nucleus within it (like a sluggish compass card, that remains behind, when the ship's head moves round), it does not matter whether we say, in about 604 years, the outside shell of the earth makes one revolution ahead of its contents, or whether we say, the latter remains one revolution behind the former; the effect is the same, provided we can prove the nucleus of the earth to be the carrier of Terrestrial Magnetism; because in that case the nucleus with its Terrestrial Magnetism would be like a powerful magnetic needle (suspended in a spherical compass bowl), moving in a liquid (like in an ordinary liquid compass).

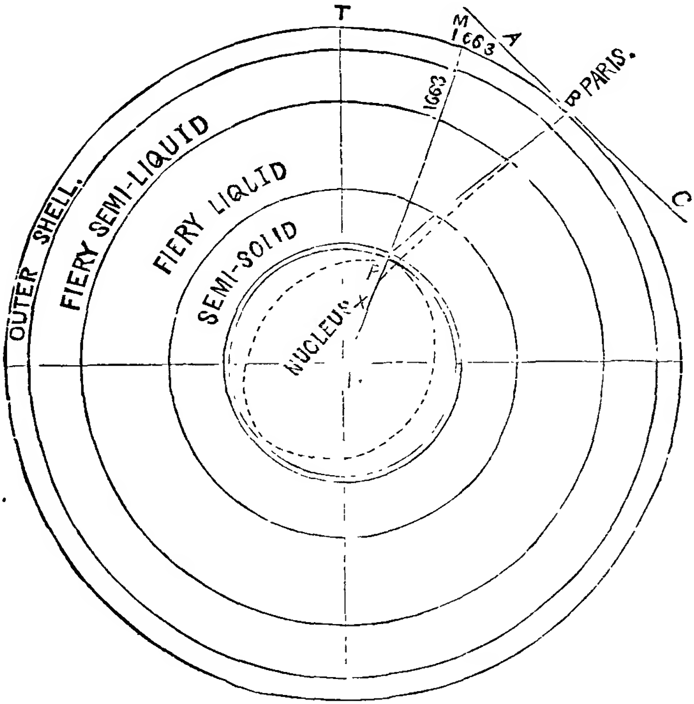
In the next chapter it will be attempted to shew the high probability why the nucleus of the earth should be the carrier of Terrestrial Magnetism.

Chapter III.

In the accompanying figure, let M represent the magnetic pole in 1663, passing between the true North Pole T and the geographical position of Paris. A—C is the horizontal line at Paris, and the angle A B P of 75° the assumed maximum dip of Paris in the same year, probably near the truth; P is a point in the interior of the earth, where the inclination needles from, the surface pole M and Paris, would intersect at the pole of the nucleus P, fixing as it were, the latter by crossbearings,

I am aware, that in reality this is not exactly the case, but do not doubt that a good mathematician could easily lay down

the unknown point X accurately, the position of the actual magnetic pole upon the earth's nucleus :—



Commander W. Walker, R.N., in the before mentioned book, says, (page 17), after giving a list of bodies capable of magnetism besides iron, " Sir W. Harris found, that by condensing " metals, their magnetic energy was increased, and that sub- " stances remain magnetic or take up magnetism more quickly, than they part with it."

This seems to imply, that magnetism can be generated in bodies by increasing their density, or, as I may say : if the density of bodies is increased by external force, then the latter performs partly the work, which previously affinity had to do, in keeping the molecules of the bodies together, and hitherto latent affinity becomes free, putting in an appearance as magnetism ; or, by high pressure, a certain amount of affinity of bodies, through increasing their density

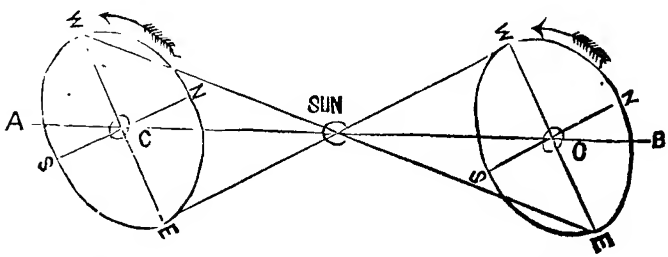
mechanically, becomes free and translated into magnetism. For fuller exposition of this view see first appendix.

Now I believe the enormous power of gravity a couple of thousand miles below the surface of our planet, of which a rough estimate has been introduced in the preceding chapter, sufficient to disengage enough molecular affinity and translate it into what we call terrestrial magnetism, to account for all phenomena of the latter.

The magnetic matter of the nucleus would settle itself in the axis of the earth's rotation, because there it would be least disturbed by the centrifugal force of the daily revolution; round the poles of the nucleus, all bodies of a higher magnetic capacity contained in the molten mass between nucleus and crust, would collect, especially iron, nickel, cobalt, etc., the same as iron filings gather to the poles of a magnetic needle; or much in the same way as we arm a natural loadstone magnet at the poles by soft iron; the whole magnetic apparatus would most likely represent an oval shape.

The explanation here introduced may be right, or wrong, still terrestrial magnetism tells us by the inclination needle from its residence, and no doubt also its cradle, the nucleus of the earth; "J'y suis, j'y reste," and my principal endeavour is to account for its *periodical changes* only.

Chapter IV.



No. 1 No. 2

Figure No. 1 is the spheroidical form of the earth at the summer solstice; A B is the plane of the ecliptic; W E the plane of the equator; N S the polar axis, and to the right is the sun.

During the summer solstice the sun attracts E more than C or W; the effect of this would be to place N S at a right angle with A B in the direction of the arrow; this is prevented by the centrifugal force of the earth's daily revolution from west to east, which brings constantly other masses of the revolving

earth under the stronger point of attraction of the sun in E; the consequence is a circulation of the earth's more yielding fluid interior, as a result of the parallelogram of forces brought to bear upon it; this circulation, if graphically illustrated, would represent an oval shape, the greater axis of which would be congruent with the axis of our planets magnetic nucleus.

In figure No. 2 is the earth at the winter solstice; W is more attracted than C and E; the tendency is to elevate N S at right angles to A B in the direction of the arrow; the influence upon the interior is the same as in fig. No. 1.

Place sun and moon for ever on the equator, or place them for ever at the poles, and the magnetic axis of the earth would soon coincide with the axis of rotation, because the interior circulation would then be deprived of its reason to exist.

It will be seen that during the summer solstice the influence of the sun's attraction must be greater in the northern hemisphere, which will cause the greater amplitude of magnetic fluctuations during the summer months; during the winter months the sun's attractive power must be less in the northern hemisphere, consequently also the amplitude of hibernal magnetic fluctuation.

During the equinoxes the sun's attraction is impartially exercised in both hemispheres, and now the moon's influence becomes to be most apparent, her attractive power being so much greater than the sun's, because she is so much nearer the object of attraction; add to this the celerity with which she constantly changes her position and it will be accounted for why Father Secchi says: "the annual disturbances of the magnetic elements are at a maximum at the equinoxes, and at a minimum at the solstices."—(Merrifield.)

The magnetic equator laid down on a terrestrial globe almost coincides with the plane of the ecliptic in the Atlantic Ocean; from the interior of South America it runs in a W.N.W. direction towards the geographical equator and follows close to the latter a parallel course to the same across the Pacific; it crosses the geographical equator where the *plane of ecliptic cuts* the latter, and then again follows an almost parallel course to the geographical equator through the Indian Ocean; in the interior of Africa again it almost coincides with the plane of the ecliptic, substantiating as I think, my supposition, that the eccentricity of the earth's magnetic axis may be due to the tendency of the axis of rotation to set at a right angle to the plane of the ecliptic counteracted by the daily revolution round the axis of rotation.

Chapter V.

Month.	1st	2nd	Month.	1st	2nd
	′	°		′	°
Jan..........	6· 7	— 1·90	July.........	12· 1	+15·04
Feb..........	7· 4	— 0·15	August ...	13· 0	+14·43
March	11· 9	+ 2·74	Sep..........	11· 8	+11·75
April	13· 9	+ 6·88	October ...	10· 3	+ 7·97
May.........	13· 5	+10·92	Nov..........	6· 9	+ 3·25
June	12· 5	+13·94	Dec.	5· 0	+ 1·32

In the first column of above table is the mean amplitude (or angle comprised between the greatest eastern and western deviation of the needle from the mean daily variation) per month, as observed at Göttingen in minutes and tenths of arc; in the 2nd column is the result of six years' observations at Berlin, from 1829 to 1834, expressed in degrees and hundredths Réaumur, giving the mean temperature of every month.

It will be seen that the maxima of the needle's mean monthly variation in the first column does not coincide with the maxima of the mean temperature in the 2nd column, which seems clearly to prove, that thermo-electricity has not much to do in causing the daily variations; in June and July the mean monthly variations are not so great (as in the two preceding months), although they have a higher mean temperature; the reason is because on the first of July the sun is in Aphelion, and his attraction decreases inversely, as the square of his distance increases.

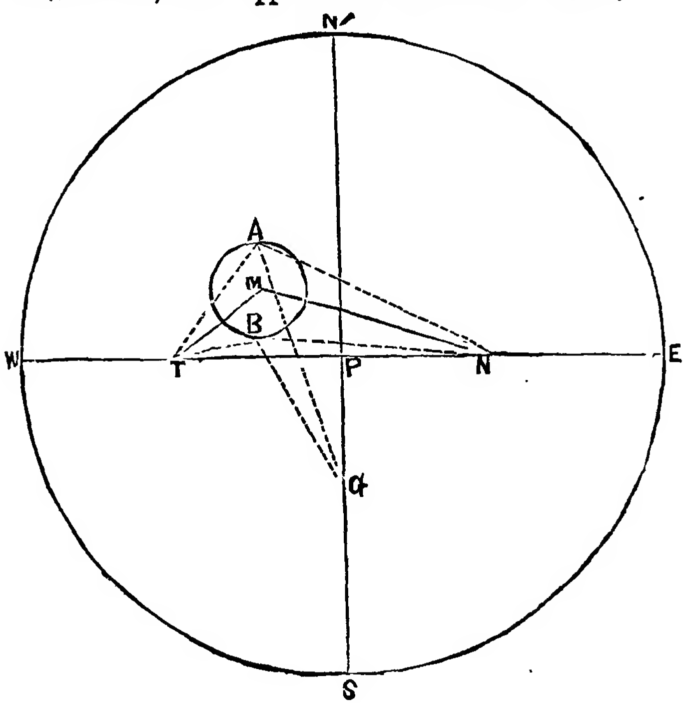
The table also shews that not in January and February, when the mean temperature is least in Central Europe, diurned variation attains a minimum, but in December, when the sun is farthest away from the northern hemisphere on account of his maximum southerly declination; another proof, that periodical change of variation cannot be dependent upon thermo-electricity produced by the sun, as supposed by many; but the greater or lesser proximity of the celestial bodies and their ever varying position principally must be looked to, to account for these periodical changes.

Unfortunately from the southern hemisphere I have no material at hand, beyond the scanty information, that the direction of the needle there is subjected to the same changes, as in

the northern hemisphere, but in an opposite direction; I have however no doubt that there the maximum of daily variation must take place about Christmas, the sun being then in Perihelion and attaining his greatest southern declination.

At the instigation of Humboldt, in the years 1828 to 1830, hourly magnetic observations were taken on previously arranged days at Berlin, Freiberg, Nicolayew and Kasan, by which a remarkable parellelism of the needles changes was proved; still more so by the labours of the Magnetic Society under the presidency of Professor Gauss, about the year 1838, to which twenty-seven observations belonged, from St. Petersburg to Dublin, from Upsala to Milan.

The following well established facts are the result of their labours; the diurnal variations are not local, but alike in places of nearly the same geographical longitude (no doubt still more so in the same magnetical longitude); if in one place a minimum of variation occurs, 90° east and west of the same, maxima will occur, but in opposite directions to one another:—



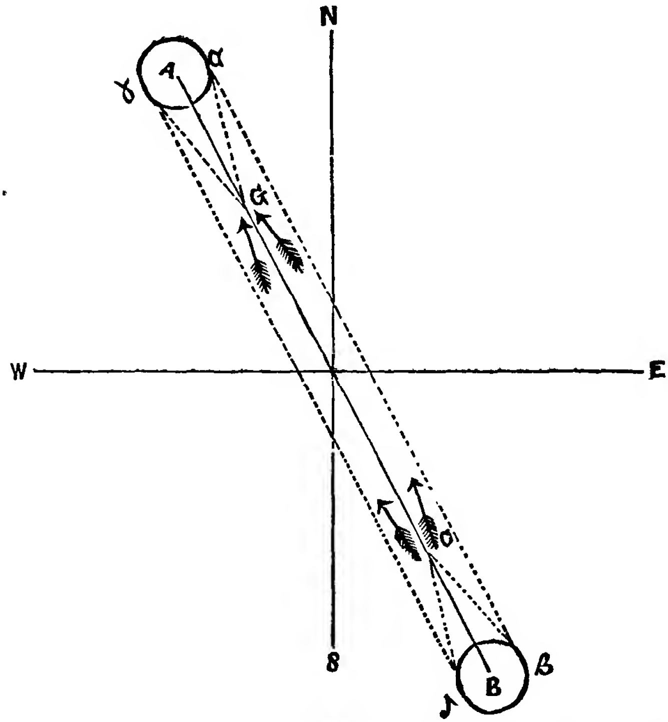
The above figure is the northern hemisphere in polar projection; N′ E S W is the equator, P is the geographical pole, M the magnetic one; T is intended for the geographical position of Toronto, N the same for Nertschinsk, G the same for Göttingen, W E is an east and west line; N′ S a north and south one. Toronto and Nertschinsk are about 180° of long. from one another, Gottingen is nearly in the middle between the two. From a diagram on page 495 of Müller and Pouillet's work, it can be seen that a maximum of easterly variation occurred at Toronto on the 27th and 28th August 1841. Angle B T M of present diagram at 1 a.m., when at Nertschinsk a western maximum (angle M N B) occurred, indicated by the dotted lines T B and B N, converging at the point B to the southward of the mean magnetic pole M; another maximum of eastern variation occurred at Toronto at 1 p.m., and at Nertschinsk was a maximum of western variation at 2 p.m.

At 11 a.m. we find in Toronto a western maximum (angle A T M) and in Nertschinsk an eastern one (angle A N M), and so forth.

A careful inspection of all the other diagrams given (and to which I must refer here, not wishing to transgress too much), makes the impression of a clearly indicated magnetic tide wave passing several times over the places mentioned; especially clearly shewn by the diagram on page 492 of M. and P.'s work, which represents the daily variation at Upsala, Göttingen and Milan, on the 28th and 29th May 1841.

This seems to suggest that indeed subterranean solar and lunar tide waves occur complicated, and interfering with one and other, and therefore apparently irregular at neap tides; but showing clearly and simple when both solar and lunar tides become united to a single one.

Now referring to our diagram (on page 11), the needle at T and N cannot point to A and B, unless at the same time the magnetic pole is in those places, and since we know, that in Europe the inclination in the forenoon is greater than in the afternoon (about 10 a.m. maximum and about 10 p.m. minimum), we would have by the diurnal periodical change a clear indication of the actual magnetic pole's revolution round its mean daily position.



In the above diagram W E is the Equator, and N S a north and south line; G is the assumed position of Göttingen in the northern hemisphere, C is the same of the Cape of Good Hope in the southern hemisphere; A is the magnetic North Pole, B the magnetic South Pole, and A B consequently the axis of Terrestrial Magnetism. Now, when in G the eastern maximum A G α of daily variation occurs, at C the western maximum β C B occurs, and the magnetic axis A B is transferred to α β; the reverse takes place, when in the northern hemisphere the maximum of daily western variation A G γ occurs, in the southern hemisphere an easterly maximum δ C B must occur, and the magnetic axis is shifted from A B to γ δ Since it is understood that the poles of the needle point towards the magnetic poles of the earth, and since the inclination needle shews that the seat of Terrestrial Magnetism (see 3rd chapter) is deeply below the surface of our planet, the only

natural inference that can be drawn must be that the attraction of sun and moon influence the nucleus of the earth in such a manner as to draw it bodily towards themselves, and so force it to circumscribe a circle with its centre round its mean daily position by following closely the movements of sun and moon from east to west; boldly pointed out by the variation needle at full and change; flickering, wavering and uncertain, when sun and moon are in quadrature; especially if we allow around the poles of the nucleus a softer magnetic matter, collected like an armisture from the surrounding molten mass.

But the centre of the nucleus cannot describe a circle round its mean daily position, without the magnetic poles also describing a circle around their mean daily position; a fact which always will be recognisable by watching closely the diurnal variations, dip and intensity included, however, much they may appear to be confused and disguised by the ever shifting positions of the heavenly bodies, and also by the increasing or diminishing distances of the magnetic poles from the observer.

Chapter VI.

Knowing that all substances are more or less magnetic, and that they are very unequally divided in the earth's solid crust, it is not surprising, that deviations of the needle from its straight direction to the Magnetic Poles should occur all over the world, causing irregularities of the magnetic lines; they are simply deviations of the needle caused by local attraction of Continents, Islands, the presence of rich deposits of magnetic substances in the vicinity, &c.; Müller and Pouillet give two points of greatest magnetic intensity on the surface of the Northern hemisphere: one in North America, and the other in Northern Asia.

For illustration, I extract one very striking instance from Dr. C. Rümcker's Handbuch der Schiffahrtskunde, Hamburg, 1857, translating from page 338, as follows:—"One of the "most remarkable phenomena of this kind is on the Northern "Coast of the Gulf of Finland, within the headland of "'Hangoe,' near the Jussary Cliffs; vessels of 12 to 15 feet "draught may pass to the Eastward of Jussary Gadder, when, "in line with Western Gadd and Lerharn, all compass needles "in 10 fathoms will turn 180° round their axis, returning after-"wards to the usual direction."

Captain Duperrey's charts of magnetic lines shew a remarkable parellelism of Magnetic Meridians between the true and Magnetic Poles, especially in the Northern hemisphere which can be best accounted for, if we admit the circulation of magnetic matter round the nucleus, deflected from the axis of rotation by the nutatory influences of the principal Celestial bodies, see 3rd chapter,

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Chapter VII.

RECAPITULATION AND CONCLUSION.

Reviewing briefly the ground we have travelled over in the preceding chapters, it will be recollected, that in the first one an explanation is given, how secular change of variation is effected; the Magnetic North Pole moving round the true one in about latitude 70° N., and about 604 years from East to West; the great closed curve of no variation divides the globe nearly in a hemisphere of Westerly variation on the right hand (looking from the Magnetic North Pole towards the true one), and the hemisphere of Eastern variation to the left (the latter enclosing an oval of Western variation in Eastern Asia); move a system of magnetic lines around the Terrestrial Globe from East to West, keeping the Magnetic North Pole on the parellel of 70° N. latitude, and the phenomena of secular variation are almost mathematically exact represented.

In the 2nd chapter it is tried to reconcile the conflicting theories of fluid interior and solid ball, in regard to the earth's internal structure, as advanced each by high authorities; introducing gravity as a highly probable agent to compress the nucleus of our planet, although of the highest temperature into a solid body of the utmost density; and subterranean tide waves are pointed out, as most likely to cause one retardation of revolution of the nucleus, suspended within a molten mass, in about 604 years.

The 3rd chapter shews by means of the inclination needle, that indeed the nucleus of our planet must be the seat of Terrestrial Magnetism, and the whole similarity of our globe to the ordinary liquid compass; the solid nucleus being the magnetic apparatus suspended near the centre of the earth by fiery liquid mass; also the possibility is hinted at, that the excessive force of gravitation towards the Terrestrial centre might be the cause of Terrestrial Magnetism. The likelihood is

represented of the whole magnetic central apparatus having an oval shape, and that the divergence of the magnetic axis from the axis of rotation may be a compromise between the centrifugal force of the earth's quotidian revolution, and the tendency of the celestial bodies to elevate the rotatory axis of the fluid interior at right angles to the ecliptic (owing to the spheroidical shape of the earth), by an ecliptic circulation of fluid mass.

In the 4th chapter sun and moon are called upon, to explain by their attraction and different positions at various times of the year the periodical annual changes, and the improbability is shewn of thermal-electricity being the cause of them, as most authorities on this subject seem to have surmised.

In the 5th chapter, it is shewn how a daily displacement of the magnetic axis takes place; and since that can hardly be done, unless the magnetic body itself be displaced, it must be accepted as proved, that the magnetic terrestrial nucleus itself is being removed, attracted towards sun and moon, and thereby describing a circle round its mean daily position from East to West, following the movements of sun and moon, causing thereby a daily nutation of the actual Magnetic Poles round their mean daily position; this actual displacement of the nucleus in the direction of sun and moon, when both pass the meridian together would to my mind account better for a *flood wave* occurring 180° away from the meridian passage, than the best calculation I have ever seen, but never clearly comprehended, concerning this phenomenon.

What Humboldt has called magnetic storms is perhaps most likely to happen, when perigee and full moon occur together, especially at the time of perihelion; and the inhabitants of volcanic regions may then stand by for subterranean squalls. The diurnal nutation of the magnetic poles may be obscurely indicated only, sometimes by the declination needle for reasons pointed out; but it is imperatively proclaimed by dip and intensity, which clearly establish an approach of the magnetic pole during twelve hours towards the observer and the departure from the same during another twelve hours.

The result of these various movements is an epicycloidal track of the magnetic poles round the true ones in about 604 years from east to west.

The 6th chapter treats on some minor matters, pointing out the probable influences of local attractions, etc.

Many ideas which suggested themselves while writing, I have excluded, as not immediately bearing upon this subject; but perhaps may add them on some future occasion, as an appendix.

My sources of information have been mentioned in the body of these pages.

I trust it can be admitted in fairness to the writer, that nowhere wild speculations, which cannot be substantiated, have been advanced; but that everywhere only natural inferences have been drawn from established facts.

I cannot close this essay without acknowledging gratefully my indebtedness to Captain J. H. P. Parker, Commander of the China Navigation Company's steamer *Newchwang* for the many facilities and valuable assistance rendered me, while writing the preceding chapters.

Owing to the limited material at my command, when compiling these pages, my judgment may have erred on minor matters; but I believe to have given *at least in rough contours* a correct theory of Periodical Change of Terrestrial Magnetism.

Note.—Since the manuscript has been returned to me to see the proofs of the woodcuts, I have had an opportunity to read Mary Somerville's "Connection of the Physical Sciences," in which the view is advocated, that Terrestrial Magnetism owes its existence to induction by electricity, evolved by the earth's revolution around its axis; but I am more in favour of Sir W. R. Grove's opinion, who in his "Correlation of Physical "Forces," London 1874, page 9 says:—"But magnetism may "now be said with equal truth to be the cause of electricity, "and electrical currents may be referred to hypothetical mag- "netic lines; if therefore electricity cause magnetism and mag- "netism cause electricity, why then electricity causes electri- "city, which becomes, so to speak, a *reductio ad absurdum* of "the doctrine." However electricity certainly does cause electricity by induction in bodies near it.

Mrs. Somerville writes in her above named work: "Dr. Far- "aday observes that such is the facility with which electricity "is evolved by the earth's magnetism, that scarce any piece of "metal can be moved in contact with others without a deve- "lopment of it, and consequently, among the arrangements of "steam engines and metallic machinery, curious electro-mag- "netic combinations probably exist, which have never yet been "noticed." Perhaps I may be excused for introducing here an extract from a letter addressed to the editor of a local paper as a curious specimen of terrestrial magnetic action:—

STEAM NAVIGATION.

Having noticed the extremes of propeller blades to be more subject to corrosion at their front than anywhere else, I have asked several profes-

sional gentlemen for an explanation, without however receiving a satisfactory answer.

It appears that the brass sheathing of the shaft, etc., in connection with the propeller, forms a closed circuit in the sense of the *British Association Experiment* (compare Deschanel's Natural Philosophy, by Professor Everett, London, 1873), and that *the electric currents* generated by the metal's rapid revolutions across *the field of force of terrestrial magnetism* have the tendency to escape by the most projecting points, which, in our case, are the propeller blades. Now, the nearest and most powerful conductor for electricity is the iron ship immediately in front of the blades, and "there appears to be no real exception to the rule that electricity, in "traversing an electrolyzable liquid, always produces its full equivalent of "decomposition."—(Ibid, page 646).

The "electrolyzable liquid" in this instance is water, which, being decomposed into its constituent elements, hydrogen and oxygen, will allow some of the latter to combine with the metallic surface of the electrode—(front of blade)—forming oxide, *i e.*, corroding those parts of the blades in question.

The above may appear to many readers an idle speculation without a practical object, because the generation of electric and galvanic currents and their consequent chemical action cannot be prevented; but a means of escape more eligible to the current can be provided by a cylindrical circumference (like a hoop) of thin boiler plate, connecting or rather encircling the blades and projecting an inch or two towards the ship, the width of the ring to be decided by experience. The electricity would escape by means of this convenience, and would *corrode it instead of the propeller;* affording at the same time additional protection to the latter from fouling by ropes, fishing gear, etc.

Friends to whom I submitted the idea embodied in this extract objected to it as unpracticable; but the very screw propellor has been opposed by parties then considered competent, as impractical and objectionable, until practically introduced and approved.

FIRST APPENDIX TO "PERIODICAL CHANGE OF TERRESTRIAL MAGNETISM."

1.—*On the nature of Terrestrial Magnetic Poles.*

Some interesting information concerning Terrestrial Magnetism is contained in the introduction to Horsburgh's first volume of the India Directory, 6th edition, London, 1852. Captain Horsburgh says, page XVII:—"Mr. John Churchman, an American who was a member of the Imperial Academy of Sciences, "St. Petersburg, and Mr. Ralph Walker, the civil engineer, "formerly of Jamaica, appear to have published, nearly at the "same time, an ingenious hypothesis with a view of solving all "magnetical problems, relating both to the vertical and hori-

"zontal declination of the needle. In a diagram of the two "hemispheres on the plane of the equator, drawn by Mr. "Walker upon this principle, there are two magnetic poles re-"presented at different distances from the poles of the earth, "and revolving round the latter in unequal periods of time. "The north magnetic pole is placed for the year 1794 in lat. "71° N., long. 80 W.; the south magnetic pole in lat. 65° S., "long. 130 E., and by the intersections of the magnetic meri-"dians with the terrestrial meridians, the variation of the nee-"dle might be found by inspection on these hemispheres for all "places on the surface of the globe, were the positions of the "magnetic poles well ascertained and correctly laid down, and "the needle not subject to aberrations from various causes al-"ready mentioned.

"But exclusive of the perpetual aberration of the needle "from permanent causes of nature, it is likewise subject to ad-"ventitious and local attractions, liable to operate in a consid-"erable degree against the accuracy of any theoretical solu-"tions.

"Mr. Churchman supposes the periodical revolution of the "north magnetic pole round the North Pole of the earth to be "1,096 years; and the revolution of the south magnetic pole "round the south terrestrial pole to be 2,289 years, its motion "being much slower than that of the north magnetic pole, "which is the cause of perpetual irregularities of the variation "of the needle. He is of opinion that when one of the magne-"tic poles is in the zenith of any place, magnetic tides or great "inundations will there be experienced; and when the magne-"tic pole is far distant from any place, the sea will recede, and "alluvial land will be formed. Mr. Walker, besides his dia-"gram for showing the horizontal declination of the needle, has "drawn two hemispheres on the plane of the equator, for shew-"ing the vertical declination or dip of the needle for all places "on the globe; and in addition to his improvements on steer-"ing-compasses, he has invented a meridional compass for "shewing the quantity of variation by inspection at any time "of the day.

"The celebrated Dr. Halley was of opinion that the varia-"tion and dip of the needle could not be resolved consistently, "on the supposition of the earth having only one magnetic "axis and two magnetic poles; and he inferred that two mag-"netic poles must exist in the northern hemisphere, and two "also in the southern hemisphere of the earth, in order to ac-"count for the discordant magnetic changes.

"Professor Hausteen justly esteemed for his profound investigations of magnetical phenomena and for his researches in Siberia and other places to ascertain the magnetic influence and intensity, has discovered the existence of a magnetic pole in that country, Siberia, which leaves no doubt that there are two magnetic poles in the northern hemispheres: and as the late expeditions of our enterprising navigators have proved the existence of another magnetic pole in lat. 70° 5¼ N., long. 96° 46¾ W., by the observations of Captain Jas. Clarke Ross, Dr. Halley's inference seems to have been correct, and may soon be demonstrated by similar researches in the southern hemisphere, where the existence of two magnetic poles will probably be discovered.

"According to the recent researches of Professor Hausteen, the earth has four magnetic poles, all revolving in the neighbourhood of the geographical poles; and the periods of these revolutions are respectively about 4,600, 1,740, 1,300 and 860 years. These times, though long, as historical periods, are short compared with many of those cycles of which geological researches and astronomical calculations seem to prove the existence.

Müller-Pouillet informs us in his popular work on cosmic physics, that there are two foci of magnetic intensity in the northern hemisphere; one in northern Asia; and a stronger one in North America; but the magnetic poles where the inclination needle stands vertical and towards which the declination needle points, is not remarkable as a focus of greatest magnetic intensity.

In the Admiralty Manual for the deviation of the compass 3rd edition, London 1874, page 102, it is stated, "in the northern hemisphere there are two such foci; and it is believed there are two corresponding in the southern hemisphere. These foci of magnetic force are of unequal strength; in the northern hemisphere, the strongest or the American focus, lies to the S. W. of Hudson Bay near the great system of the North American lakes; the weaker or the Siberian focus may be assumed as in lat. 70° N., long. 120° E. In the southern hemisphere the position of the stronger focus may be assumed in lat. 70° S., long. 145° E., and the weaker is probably in lat. 50° S., long. 130° E."

Leaving out the probabilities and what is believed and what may be assumed concerning the southern hemisphere and dealing with the better established facts in the northern one only, the truth appears to be the following:—Hausteen, Halley,

Churchman, Walker and others by assuming more than one magnetic axis and more than two magnetic poles, have created a greater complication of the phenomenon than really exists, and trying to dissolve the mysteries of these self-created perplexities by elaborate calculations, they have arrived at more or less erroneous results.

I am confident if the cause of one of the magnetic foci in the northern hemisphere were to disappear suddenly, then what is now the magnetic north pole, would vanish just as suddenly and the remaining magnetic focus would become the magnetic north pole, for the following reasons: one magnetic focus prevents the needle from pointing in the direction of the other focus, but forces it in line with the diagonal of the parallelogram of magnetic forces towards the place designated as magnetic north pole; the same is the case with the inclination needle; each magnetic focus prevents it from being perpendicular at the other, and where it really does stand perpendicular, again is the magnetic north pole fixed by the parallelogram of forces of both magnetic foci. This magnetic pole naturally must be in line between the two foci of magnetic intensity, nearer to the stronger than to the weaker,—in this case, nearest to the American focus, which is in reality the case. From the preceding it will be seen that it hardly would be surprising, if earlier writers on this subject had assumed three magnetic axis, and half a dozen magnetic poles, rendering thereby the aspect of the whole phenomenon still more intricate. However the object of these lines is not to criticise my predecessors, but to advocate and of course submit to criticism my own views.

From a remark by General Sabini (Mrs. Somerville's Connection of Physical Sciences, Section XXX) it appears that Captain Ross has not been exactly at the magnetic north pole; "the spot where Captain Ross observed the needle so *nearly* "vertical in 1831 marks the approximate position of that locality at that epoch."

The fact is no doubt as I have stated, that the magnetic pole is no fixed spot of a certain small extension, but constantly fluctuating, of diurnal and secular change,—moving in an epicycloidal track round the geographical poles.

2.—*On the Nature of Foci of Terrestrial Magnetism.*

It will be recollected from the 4th Chapter of the essay on Periodical Change that by the combined efforts of the earth's re-

volution and the attraction of the sun upon the earth's protuberance at the equator (owing to our planets spheroidical shape) an elliptic current round the terrestrial magnetic nucleus was supposed to be created which, if seen from the magnetic equator, would represent a flat oval figure with its greater length in the direction of magnetic axis; if viewed from the magnetic north pole it would also represent an oval shape, the thinner end towards the axis of the earth's rotation; the whole perhaps would have a somewhat twisted appearance, owing to the fact, that during the winter solstice the nutatory circulation current would be accelerated in the northern hemisphere, on account of the sun's greater attraction in perihelion, tending to elevate more the northern half of the axis of rotation at a right angle with the plane of the ecliptic, than the southern half during the summer solstice, because of the sun's lesser attraction in aphelion. This would indeed let it appear possible that the northern magnetic pole might revolve faster round the globe than the southern one, as Mr. Walker and others seem to have supposed.

The foci of the ecliptic current as viewed from the North Pole would in all probability be corresponding to the foci of Terrestrial Magnetism upon the surface of the northern hemisphere. This idea receives confirmation, if we inspect the charts by Captain Duperrey, of the French Navy, in which he lays down in horizontal projection the isodynamic lines round the point of intersection of the meridian of Paris with the parallels of 60° N. and S. latitudes; the same idea is conveyed by the inspection of the charts of the magnetic meridians and parallel curves in polar projection by the same officer; and since from the preceeding chapter we have seen that the magnetic axis of the earth depends upon the relative positions of the magnetic foci to one another, then it will become more easy to understand how the apparent irregular fluctuations of diurnal variation are brought about; the sun and moon passing together or separately once over the astronomical meridian of every individual focus of intensity, and once over the meridian 180° distant from it, would cause one lunar and one solar subterranean tide wave to pass twice in 24 hours over every one of the four supposed magnetic foci, except of course at spring tides, when lunar and solar tides become united into one, each tide wave would alter to a certain extent the momentary position of the respective focus, and would thereby affect the direction of the magnetic axis and of course the position of the magnetic pole, consequently also the variation of the needle. This theory would

account better for the changes of diurnal variation, than the resemblance of the isothermal curves with the isodynamic ones, because the former can be considered stationary for our purpose, while the latter do change. If it could be proved impossible to admit the quotidian displacement of our planets magnetic nucleus (by the sun's and moon's attraction), causing an independent circular motion of the same as pointed out in Chapter V of Periodical Change, then perhaps the idea demonstrated in this present chapter may also be found sufficient to account for all phenomena of diurnal variation; but considering that our whole globe is constantly kept off its mean orbit round the sun by gravitation and since it is consequently not the centre of the earth, which describes the mean orbit round the sun, but a certain point, which is the centre of gravity between earth and moon combined together (making the real track of the earth resemble the pitch of a screw propeller through the water), I believe it indeed possible, that the solid nucleus in the fluid interior of the earth under the influence of gravitation towards sun and moon may have an independent motion as described in Chapter V.

Could we from a magnetic focus on the surface of the earth see the currents of the interior, I think it likely that a rotatory motion would be noticed at each focus round an axis, connecting the focus in question with the corresponding one in the opposite hemisphere, and in the same direction, as the main circulatory current, with the sun.

3.—*On the present shape of the Agonic Lines.*

The simple relation between magnetic focus and pole as demonstrated, and its effect upon the magnetic needle is interfered with by two principal causes, if we disregard possible local attraction of Continents, thermal-electricity, &c., supposed by many competent authorities to influence the variation.

The first principal cause producing, what may be called a deviation of the declination needle from the magnetic meridian is best illustrated by the oasis of Western variation in China and Japan, and caused by the occurrence of the Siberian focus to the Northward and Westward of it; magnetic attraction, like gravitation, increases inversely, as the square of distance decreases, and the Siberian focus being nearer than either pole or other focus, it naturally deflects the North end of the needle in all places within this oasis of Western declination to the

Westward; and again places in the Northern hemisphere immediately to the Westward of this oasis (which indeed ought to have Westerly variation, if the needle were allowed to point to the Magnetic North Pole), shew Easterly variation, because the nearest focus of magnetic intensity (the Siberian one) is to the Northward and Eastward of them. Now supposing the system of magnetic lines to revolve with the magnetic poles from East to West, this repeated change of secular variation from West to East and *vice versâ*, several times over again at the places in the track of this peculiar insula of Western variation would make upon an observer the fallacious impression, that the Magnetic North Pole were moving occasionally in opposite directions; but in fact it proves only, how the plurality of magnetic foci may cause contradictory irregularities in the arrangement of Isogonic lines.

The second principal cause of deviation of the needle from the direction towards the nearest magnetic pole is the existence of the second magnetic pole in the other hemisphere, tending to draw the opposite end of the needle towards itself, to make it parallel with the magnetic axis, *which coincides nowhere* with the axis of the earth; this is well shewn by the shape of the Agonic line passing through America; the difference of longitude between the North and South Pole across the Pacific being only about 110°, the South end of the needle anywhere to the Southward of the Magnetic North Pole and near its meridian having the Magnetic South Pole at its left (when looking towards the centre of the earth), is drawn in that direction, the more, the further to the Southward, and as a matter of course the North end of the needle deviates just as much to the right, or the Eastward, causing the whole Agonic line in that part of the world to encroach upon certain regions of our globe, which otherwise would have Westerly variation; the same effect of the South Pole upon the needle's South end can be proved along the Southern part of the Agonic line passing through Australia; the meridians of the two Magnetic Poles across the Pacific again are only 110° of longitude apart, but *viâ* the Indian Ocean and the Atlantic they are about 250° difference of longitude apart; the consequence is, that the South end of the needle is drawn in the nearest direction towards the Magnetic South Pole, in this case to the right, or Eastward; the North end of the needle must deviate just as much to the left, or Westward, causing in the Southern hemisphere an inroad of Westerly variation into regions, where otherwise Easterly variation ought to be.

Assuming, that Hausteen and Walker were correct in letting the Magnetic North Pole revolve faster than the Southern one, then during one revolution, the former would be once on the meridian of the latter, and once 180° from it; in both cases the geographical meridian would coincide with the line of no variation, and the Eastern and Western variations would be equally divided, as stated in a previous chapter. These supposed unequal motions of the two magnetic poles would cause alternately contortions and distortions of the magnetic axis, and then periodical changes of the geographical latitude of the magnetic poles might presumably also take place.

4.—*Tidal Motion and Diurnal Variation.*

In order to form an idea how the position of the magnetic foci and poles may be affected by the influence of subterranean tidal movements, besides the mere perpendicular tide wave, it is necessary to have before our mental eyes clearly our knowledge of oceanic tide waves, because it is reasonable to suppose that the one must behave analogue to the other.

It is not my intention to reproduce in this chapter what may be read in every good work on tides; but I wish to draw attention to a fact which appears to have been overlooked at least by those writers, whose works I have had an opportunity to consult; I cannot illustrate better what I mean than by making a few extracts from a couple of nautical works. First from the China Sea Directory, Vol. III, 1874, page 350 and 351:—

"The tidal streams at the entrances of the Yangtsze from "Gutzlaff to Shaweishan rotate, performing one revolution "(with the sun) in 12 hours. To the southward of Gutzlaff "the tides are also rotatory, but not with that regularity which "is observed about the Amherst Rocks. There is also reason "to believe, although the fact has not yet been conclusively "established, that they preserve the same character some distance to seaward, and far to the northward. During its revolution the direction of the stream changes about two points "every hour, excepting when veering from N. W. to N. E. "about the time of high water, and from S. E. to S. W. about "the time of low water, when the change is more rapid. The "northern stream for the most part makes and completes the "flood, and the southern stream for the most part makes and "completes the ebb, although the first part of the flood is made

"by the southern stream, and the first part of the ebb by the "northern, called sometimes "tide and half tide."

"Mr. G. B. F. Swain, master of H. M. S. *Pilot*, 1850, states "that the revolving tide has been noticed as far out as the Sad- "dle Islands, whilst others assert that the stream when fully "made sets N. W. by W. and S. E. by E. These statements "are not contradictory. Lieut. C. Bullock, R.N., found the "tides to rotate, 120 miles north of the entrance, at 70 miles "from the land."

Captain Horsburgh gives in his India Directory, Vol. I, page 599, the following table concerning tidal motions off the river Hoogly, when uninfluenced by the wind:—

"1st quarter	flood	N. W. by W.
"2nd ,,	,,	N. N. W.
"3rd ,,	,,	N. N. E.
"Last ,,	,,	E. N. E.
"1st quarter	ebb	S. E. by E.
"2nd ,,	,,	S. S. E.
"3rd ,,	,,	S. by W.
"Last ,,	,,	S. W. and W. S. W."

This is a complete revolution (with the sun), in the bay of Bengal, the same as off the Yangtsze.

Lately I have heard that "divers" engaged in salving operations in the vicinity of the Lammock Islands (Formosa Channel), have also observed a rotation of tides in that locality. From personal experience I am able to add the following fact:

In the summer of 1874, when commanding the British barque *Charley* of Hongkong, I was becalmed for several days during a voyage from Japan to Shanghai; to judge by the lead, the currents appeared very unsteady, setting at different times in different directions. I had good observations and found that I was drifting away towards the Strait of Corea, which set I attributed to part of the Japan stream (Kurosiwo current), branching off in that direction; determined not to lose more ground than could be helped, I brought up with the stream anchor on the great Yangtsze bank, about half way between Quelpart and the Saddle Islands in 23 fathoms. Remaining there some time for want of wind, I was much surprised to find the tides rotate with the same regularity as off the Yangtsze (with the sun), which accounted for the seeming irregularities of currents, indicated when consulting soundings only.

By these facts I am led to believe that tidal motion (if not

interferred with by the shape of neighbouring continents and Islands or Galese), in the northern hemisphere always takes place from north, through east by south and west; in the southern hemisphere of course in the opposite direction; to verify this latter supposition the information contained in the 7th edition of Horsburgh is not sufficient; generally the establishment of the port and the rise and fall are only given for most places in the southern hemisphere; but I am confirmed in my opinion by much, what Horsburgh relates of equatorial regions. In the second volume of the India Directory he says on page 759 about Sourabaya Strait:—" Ships are sometimes "detained upon the bank, or at the entrance of the channel, "by the singular tides which prevail there, and for which "science has not yet been able to account, or the pilots even to "reduce to rule. In the chart of the channels leading to Sou-"rabaya, by Lieut. M. H. Jansen, D.R.N., the depths are "given at low water, and the following remarks are made on "the tides:—" During the months in which the sun is on or "near the equator, *i. e.*, in March, April, September and Oc-"tober, there are in this channel, at the full and change, two "tides in 24 hours; but at the quarter moon's, as well as dur-"ing all the other months, there is only one tide, and it makes "low water in the night with south declination, and in the day "when the sun has north declination.

"The greatest rise and fall of spring tides is 6 feet, and it "occurs only in those months when there is but one high "water in the 24 hours, and 3 or 4 days after full and change. "The least rise and fall is 4 feet, and this takes place at the "full and change also, but only in the months when there are "the two tides, which may be regarded as a change for the "day-high-water to the night-high-water, and vice versa. At "the quarter moons of these months the water rises 5 feet, and "in every other month 5½ feet above the depths marked in this "chart.

"In the month of May it is high water between 21½ h. and "0½ h.; June, 20 h. and 0½ h.; July, 19 h. and 0 h.; August, "16 h. and 0 h.; November, 10 h. and 12½ h.; December, 8 h. "and 12 h.; January, 8 h. and 12 h.; February, 7 h. and 12 h.

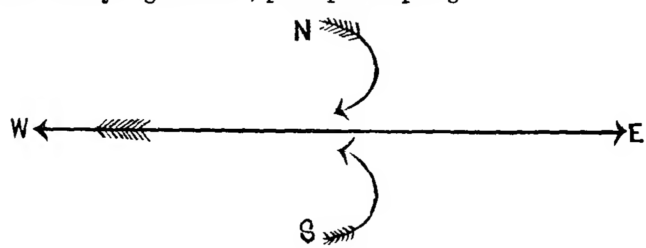
"At the spring tides, as well as at the quarter moons, it is "high water always at 10½ h. or 22½ h.

"During the months when the two tides occur, it is also "high water at 10½ h. and 22½ h. These two tides are, how-"ever, different in height; and when the sun's declination is "north, the morning tide is the highest; but when it is south,

"the evening tide. In those the quarters which give but one "tide,(1) give the higher water as at full and change."

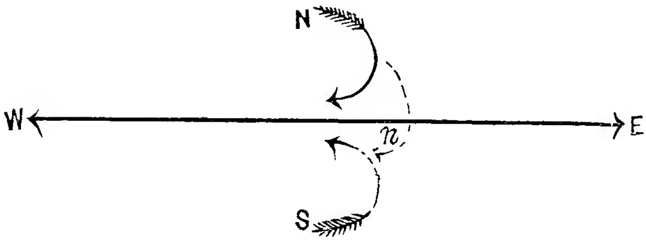
Now I believe that during the sun's northern declination the tides in Sourabaya Strait do rotate the opposite way, as off the Yangtsze; during his southern declination the tides are also rotatory, but the same way as the Yangtsze tides. During the two equinoxes then it will be difficult for local pilots even "to reduce the tides to rule," because the tides changing from one rotation *i. e.* with the sun, to the other, *i. e.* against the sun, or vice versa, may appear to become to a certain extent confused and irregular.

I will not transgress too much by recording more instances of apparently irregular tides, as I could; but refer for one remarkable instance more to page 737 of the same volume of Horsburgh's, concerning Pitt Strait, where several vessels by the tides setting consecutively in "all directions" running considerable danger: I believe, if they could have anchored they would, (as I did on the Yangtsze bank in 1874) have experienced a rotary regular tide, perhaps at springs:—



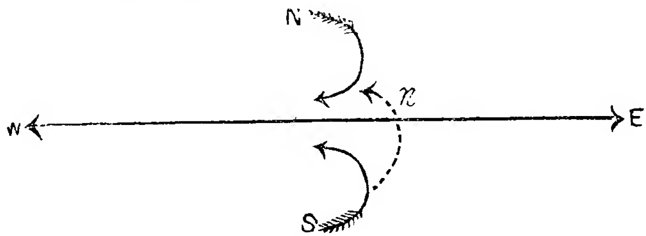
W E is the equator, the curved arrow N indicates the rotation of tides in the northern hemisphere, the curved arrow S shews the same in the southern hemisphere; supposing the strait arrow at W to point out the direction of the flood tide on or near the equator, then the flood and ebb currents will occur at the same time on both sides of the equator, and places near it will have two regular tidal revolutions in 24 hours. At neaps the flood wave resulting from the moon's lower meridian passage becomes so much counteracted by the sun in quadrature, that it is scarcely noticeable, or incapable to overcome the *vis inertiæ* of tidal motion, resulting from the moon's upper meridian passage; then places like Sourabaya Strait will only experience one flood and one ebb in 24 hours.

(1) Horsburgh's tidal account of Banca Strait resembles in many points that given of Sourabaya Strait.



During the sun's southern declination the northern currents stretches over across the equator and arrives retarded at N, continuing the southern already finished flood stream for another 6 hours; a singular phenomenon occurs, with the ebb stream, thereby allowing only the effects of the upper meridian passage to appear as one flood and one ebb in 24 hours.

The seeming irregularities of tides must be greatly increased by the circumstance of the principal factor in their production, *i. e.* the moon, crossing and recrossing the equator so many times during the year :—



In the above figure W E is the equator during the sun's northern declination; the stream from the southern hemisphere crosses the equator to the northward in the direction of the curved arrow S N and continues the spent tidal movement in the northern hemisphere similarly as in the preceding case; the consequence is the same; one complete tidal rotation in 24 hours only.

If this view of oceanic tidal motion can be accepted, then it is natural to suppose that the earth's internal fiery ocean must be equally or rather more so affected; being as many miles perhaps in depth, as the briny outside ocean is fathoms only: and then it would be easily understood that the magnetic foci and poles by being carried along with the tidal motion would cause a change of the magnetic axis in the same manner, as if the earth's magnetic nucleus were moving, as described in a

previous chapter; tidal motion or displacement of magnetic nucleus would have the same effect: change of axis of our planets magnetic internal apparatus, and thereby producing the main features of annual and diurnal variation, many seeming irregularities being the result of the unsymetric distribution of magnetic foci and poles, and the consequent eccentricity of magnetic axis. My attention has been called to Humboldt's Kosmos, vol. IV, Stuttgart and Tubingen, 1858 (" Specielle Ergebnisse der Beobachtung in dem Gebiete tellurischer Erscheinungen "), in which much valuable information is contained concerning Terrestrial Magnetism.

Humboldt states (p. 53) that the Chinese, Indian, Arabian, and Malay navigators knew the magnetic variation before Columbus; in fact Andrea Bianca had entered it on his sea charts in 1436; what Columbus did discover is the line of no variation, passing then $2\frac{1}{2}°$ east of the Azoric Island, Corvo, and I think what the Spanish savants, according to Commander Walker, refused to credit, may have been Columbus' statement, that to the westward of his newly discovered line of no variation the variation were opposite (westerly) to what at his time it must have been in Spain (easterly.)

Commander Walker gives as his source of information the Encyclopaedia Britannica.

According to the Kosmos it seems, that generally all magnetic elements have two daily maxima and two minima; for fuller particulars I must refer the reader to Humboldt's work; on page 97, however, I find it mentioned according to Sabine, that the diurual variation of intensity at Van Dieman's Land (Hobart Town) shews only one maximum and one minimum per diem; and referring to Horsburgh's India Directory, Vol. II, page 839, I find the following tidal information about d'Entrecasteaux Channel (Van Dieman's Land): "the rise of the "tide *which flowed only once* in 24 hours was about 6 feet per-"pendicular; high water from 9 to 12 hours at full and change, etc;" this is a remarkable coincidence with only one daily maximum and one minimum of magnetic intensity, which I consider may be a proof of also one subterraneous tidal revolution only in 24 hours.(2)

(2) Humboldt on page 84 (Kosmos, Vol. IV.) calls attention to a zone of weak intensity between the northern and southern magnetic hemispheres, which alternately shares the magnetic movements of the opposite hemispheres during opposite seasons, similar as I suppose a corresponding zone in the same regions, partaking alternately of the tidal rotation of each hemisphere, as governed by the declination of the sun.

Humboldt asks (on page 141) if the line of no variation, which Columbus found near the Azores in 1492 is the same that Davis and Kieling in 1607 found at the Cape of Good Hope? I think not; Columbus's Azoric line must be the one, which now passes through the sea of Ochotsk, the Kurile Islands and to the eastward of Japan; and Davis's and Kieling's line must be the one, which Muller and Pouillet in 1663 passed through Paris (according to Picard in 1666), and which runs now through North America and the South Atlantic.

According to Graham (the same volume of the Kosmos, page 189, Philos. Trans. for 1724-25), the variation of declination depends "neither upon heat nor cold, dry or moist air. The "variation is greatest between 12 and 4 in the afternoon, and "the least at 6 or 7 in the evening." To this Humboldt makes the remark "es sind freilich nicht die wahren wendestunden," "(but these are not the true turning hours"); I believe Humboldt is wronging Graham, who for his time may have given the true turning hours correctly, which may change with the revolving position of the magnetic poles.

In more than one place Humboldt states his opinion that temperature has nothing to do with periodical variation, and on page 192 he quotes Relshuber (translated as follows:)—"there are two maxima and two minima of declination in 24 "hours, but only one maximum and one minimum of temper-"ature." At pages 176 and 177 Humboldt quotes from Sa-"bine:—"The turning periods of the year are not, as many "might be supposed to anticipate, those months in which the "temperature at the surface of our planet, or of the subsoil, or "of the atmosphere attains its maximum and minimum. The "annual variation is obviously connected with and depend-"ent on the earth's position in its orbit relatively to the sun, "around which it revolves; as the diurnal variation is con-"nected with and dependent on the rotation of the earth on "its axis. It is a remarkable fact, which has been estab-"lished, that the magnetic force is greater in both hemispheres "in the month of December, January and February, when the "sun is nearest to the earth, than in those of May, June and "July, when he is most distant from it; whereas if the effects "were due to temperature, the two hemispheres should be op-"positely instead of similarly effected in each of the two pe-"riods referred to.

From page 82 the following is a translation:—"The princi-"pal result of researches on the magnetic influence of the "earth's satellite, which according to Melloni, only shews a

"trace of heat generation, is that the magnetic declination "upon our earth in the course of a lunar day suffers a regular "change, arriving twice at a maximum and twice at a mini- "mum. If the moon, says Kreil very properly, produce no "change of temperature upon the surface of the earth, recog- "nisable by common thermometers, then she can produce no "alteration of Terrestrial Magnetism by this means; if in spite "of this such an influence is observed, it must be concluded, "that it is "brought about by other means, than heat." This other means, I repeat it, can only be the same, which produces oceanic tides.

Humboldt says on page 189 (translation): "compare extracts "of a letter from me to Karsten, Rome, 22nd June 1805, *on* " 4 *motions* of the magnetic needle, comparable to 4 magnetic "ebb and flood tides, analogue to the barometric periods, etc."

A proof that during perihelion motion and commotion in the interior of the earth by the greater attraction of the sun must increase, is the rise of temperature in the Schergin shaft of Siberia, sunk 382 Parisian feet into the frozen ground; I translate the following from page 168:—"A remarkable and hi- "therto unexplained phenomenon is the rise of temperature, "which in winter sometimes has been noticed in the deeper "parts only, without any traceable influence from the outside."

Since the sun's greater attraction during perihelion accelerates the motion of the earth in its orbit, why should it not also increase the velocity (intensity) of the subterraneous circulatory current? and since greater motion in the earth's interior must manifest itself by a greater production of heat, we have an explanation of the phenomenon in the Schergin shaft: a translation (transformation) of the sun's greater attraction during perihelion into heat. Another direct proof of increased internal motion during perihelion. I translate from page 296: "The activity of the "Stromboll," (volcanse) is like that of the "Aetna, greatest in November and during the winter months,' *i. e.* during perihelion.

Humboldt states on page 488 that Poisson, with whom he conversed several times about subterraneous tides, thought them to be inconsiderable, and Humboldt's astronomical friend Dr. Brünnout expressed himself that internal tides could just as little take place on account of our planet's solid crust, as in the ocean, if the latter were covered with an unbreakable sheet of ice; but Ampere said that owing to the action of the moon on the enormous internal liquid mass, tides would result analogue to those of our seas, but much more terrible ("mais bien

"autrement terribles"), on account of the larger extent and greater density of the mass, it would be difficult to conceive how the shell of the earth could resist, being constantly battered by a kind of hydraulic ballista ("étant incessamment "battue par une espèce de bélier hydraulique (?) de 1400 lieues "de profondeur").

To these various ideas I can only again repeat from Mr. Kingsmill's Border Land of Geology and History, page 5:— "If the interior of the earth were liquid and its crust composed "of so rigid a material as steel, and 300 miles thick, it would "yield to the deforming influences of centrifugal force and the "attraction of the sun and moon as if it were india-rubber."

Considering all, it seems that opinions on these subjects differ widely; or to use a German proverb: "Daruber sind die "Gelehrten noch nicht einig."

To my mind there remains, no doubt, that the force of those celestial bodies which cause the nutation of our planets' axis of rotation and the precession of the equinoctial points, also do cause in the movable fluid interior of the earth those movements, which I have endeavoured approximately to picture.

Biot, Hausteen and others appear to have the idea of a magnetic nucleus before me; Humboldt objects strongly to Halley's views on this subject, but Halley placed his nucleus in a hollow terrestrial shell, while I take the *dense* state of our planets' interior into due account (see Bohn's edition of Humboldt's Cosmos, Vol. I, p. 163). Adhemar states concerning Bertrand of Hamburg: "Il supposait, que la terre était creuse "et qu'il y avait dans son interieur un gros noyan d'aimant," etc. (Croll's Climate and Time, p. 543.) I was unacquainted with these elder ideas, when I occupied myself first with the same question.

Note.—In Amadée Guillemin's "The Heavens," edited by Norman Lockyer and revised by Richard A. Proctor, the latter gentleman writes on page 391, after the current and generally accepted explanation of tidal phenomena is given: "It must "be noted, however, that although the statistical equilibrium "of a tidal wave is thus accounted for, the dynamical condi- "tions of the problem cannot be thus explained. On the con- "trary, if we consider only the dynamical rotations, we shall "find that the place of low water should be under the moon "and at the opposite part of the earth, the place of highwater "between these regions. Newton, Laplace, Airy and others "agree in this view. The theory of the tides remains yet to be "established satisfactorily. Much that has been presented in

"popular treatises as part of this theory is in reality but an "account of the results of observation.

"On the 1st of September, 1859 two astronomers, Messrs. "Carrington and Hodgson, were independently observing a "spot, when they noticed a very bright star of light suddenly "break out over it, moving with great velocity over the sun's "surface. At the same moment the magnetograph at Kew, "where all the changes in the earth's magnetism unceasingly "register themselves, was violently affected."—(Amadée Guillemin's "The Heavens," London, M, DCCC, LXXVI, page 52.)

5.—*Possible Origin of Magnetism.*

To understand the nature of magnetism, it is essential to recollect that more substances than iron, steel, nickel, cobalt and so forth, are magnetic.

Sir W. S. Harris, in his paper on the transient magnetic state of which various substances are susceptible has given the following table of the comparative magnetic inductive susceptibility of the following substances :—

Metals, &c.	Rolled Silver.	Rolled Copper.	Cast Copper.	Rolled Gold.	Cast Zinc.	Cast Tin.	Cast Lead.	Solid Mercury.	Fluid Mercury.	Cast Antimony.	Cast Bismuth.	Glass.	Marble.	Mahogany.	Water.
Comparative magnetic energy ..	33	29	20	16	10	6·9	8·7	2	1	1·8	[illegible]	0·35	0 37	0·37	0.27

Sir W. S. Harris found that by condensing the metals their magnetic energy was increased (Commander W. Walker's repeatedly quoted work "The Magnetism of Ships," page 17). From this table it will be seen that solid (which can only mean frozen) mercury is 100 per cent more capable of magnetism than the fluid mercury; but in solid mercury the molecules must be closed together than in the fluid, because the former comprises a smaller compass than the latter, and since we know that the attraction of bodies increases inversely as the square of the distance decreases, what possible reason could there be to suppose that the attraction between molecules should not increase at the same rate, should not obey the same law, if the body which they constitute does contract; in other words, when they are brought nearer to one another within the body? Now, if under ordinary circumstances this special

form of gravitation, the molecular affinity, is sufficient to keep the bodies together in their ordinary aggregate state, what must be the consequence, if by excessive pressure or by contraction a surplus of affinity is created more than is required for the existence of the body under ordinary circumstances? Nothing is more natural than that this surplus of disengaged affinity should make its presence known under some form or other, for instance, as magnetism; this is therefore an explanation for the increased magnetic capacity in solidified mercury. We may then say: by increased density of bodies magnetism is generated; iron is an instance when by some mechanical process (external superior force) converted into the denser steel.

If a magnet is heated, magnetism is lost, because it must be reconverted into original affinity to counteract the increasing centrifugal heat vibrations of the molecules.

In soft iron (says Mr. Merrifield in his severally cited work "Magnetism, etc., page 29) "where the magnetism must be "induced, the power increases with a rise of temperature to a "blood red heat. With other magnetical substances, as co- "balt and nickel, the effects of heat vary; and Faraday shewed "that some substances which at ordinary temperatures are not "magnetic, become so when exposed to intense cold."

This case of iron becoming more capable of magnetism until heated to a certain degree is one of those exceptions which proverbally prove rules; for Tyndall states in "The Forms of "Water," page 124: "Water is not a solitary exception to an "otherwise general law. Heat expands, cold contracts, there "are other molecules than those of this liquid which require "more room in the solid crystalline condition than in the ad- "jacent molten condition. Iron is a case in point. Solid iron "floats upon molten iron exactly as ice floats upon water. "Bismuth is a still more impressive case, and we could shiver "a bomb as certainly by the solidification of bismuth as by "that of water." This shews that iron passing from the solid to the molten state at certain degrees of heat must be contracting, thereby disengaging a certain amount of molecular affinity, manifesting itself as increased magnetic capacity. Having these facts (which I cannot express better than saying that by increased density of bodies capable of magnetism a certain amount of spare affinity must appear under the form of magnetism), vividly before our eyes, then it will easily be understood how terrestrial magnetism originated, if we throw a hurried glance at the earliest history of our planet.

"Supposing with Helmholtz that the sun originally existed "as a nebulous mass, filling the entire space presently occu-"pied by the solar system and extending into space indefinite-"ly beyond the outermost planet."—(Croll's Climate and Time, page 348.)

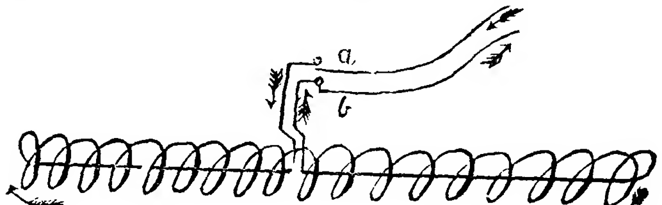
And supposing this nebulous matter sufficiently contracted, that at the outer limit or surface, mass after mass had detached itself from the parent body, forming successively the outer planets with their satellites, until our own planet was formed.

Suppose x million of years ago the diameter of the earth's body had been 10,000,000 miles, and the attraction between two neighbouring molecules=m, then y millions of years afterwards the diameter having contracted to 100,000 miles, the attraction between two neighbouring molecules must have been 100^2m, or 10,000 times greater; part of this increased power of gravitation must have manifested itself as telluric magnetism, the rest being radiated into space as heat.

It will be seen that I am trying to trace magnetism home to gravitation; in the following chapter some more weighty reasons will be produced to support this view; at present a few remarks concerning the analogy between magnetism and electricity may not be out of place.

This essay not being intended for a lesson in elementary physics, the reader is supposed to be sufficiently conversant with the action of electricity upon magnets, or of magnets upon electric currents, to understand the following deduction; but being unable to express better what I should expound first, to make the succeeding argument clearly understood, then it can be found in "Natural Philosophy," translated and edited from Ganot's Cours Elementaire de Physique, by E. Atkinson, Ph.D., F.C.S., 2nd edition, page 501.

"Structure of a solenoid.—A solenoid is a system of equal "and parellel circular currents formed of the same pieces of "covered copper wire, and coiled in the form of a helix or spi-"ral, as represented in the accompanying figure:—



"A solenoid, however, is only complete when part of the wire "passes in the direction of the axis in the interior of the helix.

"With this arrangement, when the circuit is suspended in "the mercury cups of the apparatus, and a current is passed "through, it is directed by the earth exactly as if it were a "magnetic needle. If the solenoid be removed it will, after a "few oscillations return, so that its axis is in the magnetic "meridian. Further it will be found that in the lower half of "the coils, of which the solenoid consists, the direction of the "current is from east to west; in other words the current is "descending on that side of the coil turned towards the east, "and ascending on the west. In this experiment the solenoid "is directed like a magnetic needle, and the north pole, as in "magnets, is that end which points towards the north, and the "south pole that which points towards the south."

"Mutual actions of magnets and solenoids.—Exactly the "same phenomena of attraction and repulsion exists between "solenoids and magnets as between magnets. For if to a "movable solenoid traversed by a current, one of the poles of a "magnet be presented, attraction or repulsion will take place, "according as the poles of the magnet and of the solenoid are "of contrary, or of the same name. The same phenomena "take place when a solenoid, traversed by a current and held "in the hand, is presented to a movable magnetic needle. "Hence the law of attractions and repulsions applies exactly "to the case of the mutual action of solenoids and of magnets."

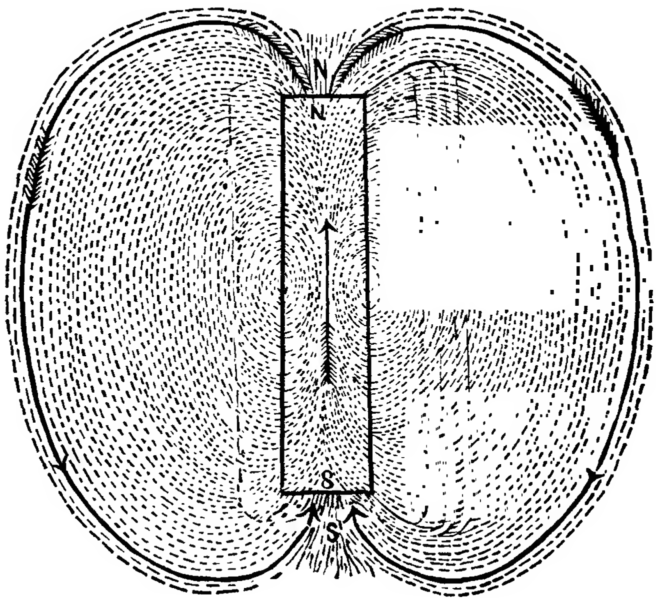
"Mutual actions of solenoids.—When two solenoids traver-"sed by a powerful current are allowed to act on each other, "one of them being held in the hand, and the other being "movable about a vertical axis, attraction and repulsion will "take place, just as in the case of two magnets. These phe-"nomena are readily explained by reference to what has been "said about the mutual actions of the currents, bearing in "mind the direction of the currents in the ends presented to "each other."

Now, if a house in all main features resembles a certain other building, both answering exactly the same purposes, then the second building must also be a house, though perhaps of another style of architecture and of different material; both must be constructed after a similar plan.

In the solenoid we see that a current traverses a wire in one direction and is conducted back spirally outside the wire beyond the opposite end, and led back again inside the spiral coil in the original direction.

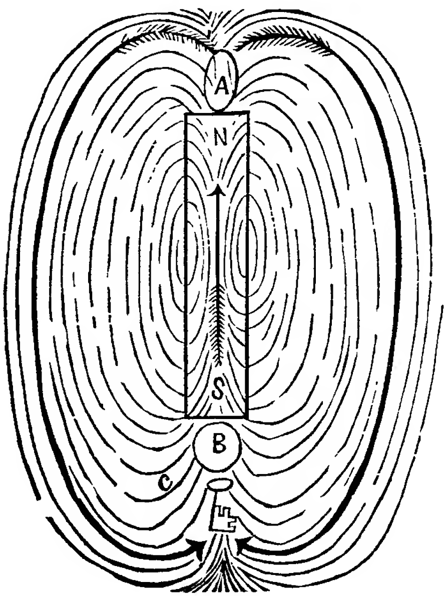
It must be the same case with the magnetic current, emanating from one pole and making its way back to the opposite pole, as best it may and as is well shewn by the familiar experiment: to cover a strong magnet by a sheet of paper and sieve iron filings on top of it; the iron filings, acted upon by the inductive currents, become arranged in regular curved filaments from one end to the other; in the centre, where the curves become so small as to neutralize one another, no action is observed; there is the magnetic equator.

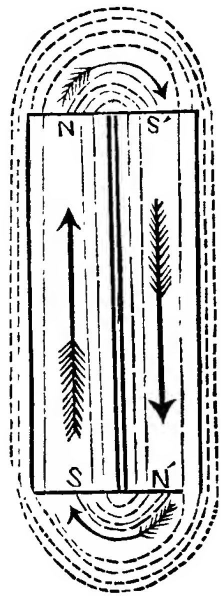
That this current from pole to pole takes place can be conclusively shewn by introducing a strong horse shoe magnet into iron filings, or amongst nails, when at once solid bridges of filings or nails will be formed, connecting both poles in regular arches (compare Faraday "On the Various Forces of "Nature," pages 50 and 170.)



N S is a magnet; the current is supposed to emanate at N and enters again at S, a continuous circulation takes place, as in a solenoid.

Place some pieces of iron A, B and C (accompanying figure) near either pole; the current will traverse them, exciting at the same time the latent magnetism of the iron to join the original current and attracting the iron towards the foci of circulation, the poles, like invisible arms of apolype; add pieces of iron ad libitum, the effect would only be to prolongate the current but every piece would be traversed by it, and become a temporary magnet.





Place a second magnet S′ N′ with reversed poles alongside the former and the circulation selects the nearest and best conductor (like a streak of lightning in a similar case), and the pieces of iron become demagnetized by the desertion of the current, and drop down, being no longer attracted. Break either of the magnets in pieces, the circulation will continue in each piece, everyone becoming an independent magnet; a flash of lightning passing through a magnet contrary to the current will reverse it and of course the poles also.

Poles of the same name repel one another until the axis of the magnets are parallel to each other (if we disregard the influence of terrestrial magnetism), and opposite poles attract

each other, to form *one* continuous current; in both cases the magnetic currents obey the law to arrange themselves parallel to one another; even in the second case, where they have the tendency to form *one* straight line, because it cannot be denied that a straight line is parallel to itself.

The attentive reader will readily observe that by this simple theory all phenomena peculiar to magnets, without a single exception, can be satisfactorily accounted for, not having recourse to Ampere's somewhat complicated artificial theory and the hypothetical two fluids: Austral and Boreal.

According to this hypothesis the earth itself would be only the vehicle of a vast magnetic current, emanating in the antarctic regions and visible under favourable circumstances as Aurora Australis, spreading towards the equator and thence converging in regular curves towards the arctic regions, where frequently visible as Aurora Borealis. It would make no difference if the current were travelling in the opposite direction; I have only assumed the former circulation, because the southern hemisphere is believed to possess more magnetic intensity, some of which might be spent by the current's passage to the northward in meteorological phenomena (thunderstorms, etc.)

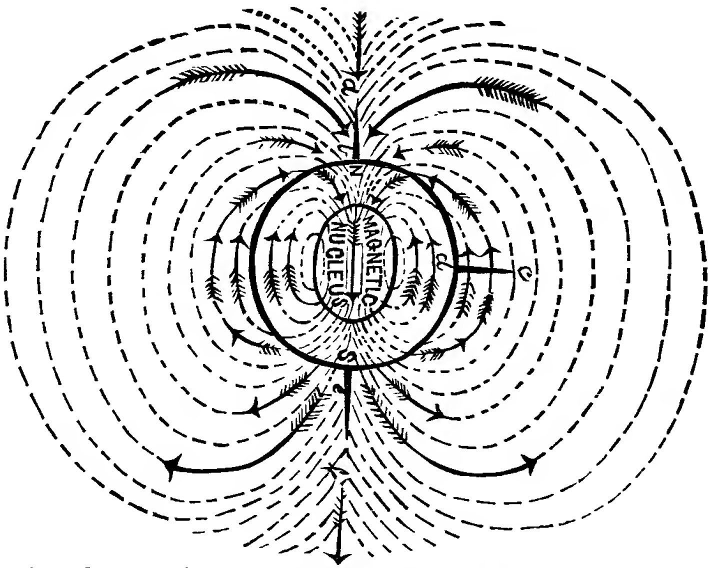
A tangent on either magnetic current curve in any place would probably be identic with the magnetic dip; might this magnetic current be the cause of atmospheric electricity and the returning current (through the earth) the cause of telluric electricity?

"Many hypothesis have been propounded to explain the origin of the atmospheric electricity. Some have ascribed it to be the friction of the air against the ground, some to the vegetation of plants, or the evaporation of water. Some again have compared the earth to a vast Voltaic pile, and others to a thermo-electrical apparatus. Many of these causes may, in fact, concur in producing the phenomena."—(Ganot's Cours élémentaire de Physique, by E. Atkinson, London, 1875, page 463.)

It would be interesting to know whether the motion of the earth's interior might be contributing to produce electricity; is it possible that the secular motion, the rotatory current and tidal action of our planets' fluid interior may produce electric currents, perhaps from east to west, according to Ampère's opinion?

The northern and southern lights probably are occurring in the highest parts of the atmospere, where it begins to become very rarified, in analogy of the electric light in vacuo, or rari-

fied vapours (compare Ganot's Natural Phylosophy, etc., etc.) page 525-526.



The above globe is the earth, N S is a magnetic north and south line; magnetic ethereal matter emanates in the southern hemisphere, probably in decentric undulations (from common centres), crosses the equator in the direction of the arrows and enters the northern hemisphere, probably in accentric undulations (towards common centres), to circulate back again through the body of the earth towards the antarctic regions, and so forth; *a b*, *c d* and *e f* represent iron masts at the poles and at the equator; they are traversed by magnetic induced currents, parallel to the nearest curves in the direction of the arrows; in the northern hemisphere *a* is the induced south pole; *b* the induced north pole of *a b*; in the southern hemisphere, *e* is a south pole and *f* a north pole of *e f* by induction from the earth; at the magnetic equator the induced magnetic current must be horizontally somewhere between *c* and *d*, like the arrow.

The arrows indicate the supposed direction of this magnetic current; the arrow heads present everywhere that end of the magnetic needle, which *on the surface of the earth is the north seeking pole.*

The tendency of all magnets below and above the surface of the earth must be to remain parrallel to this terrestrial magnetic circulation, and if there were a tunnel through the earth from one magnetic pole to the other, then the direction of the needle at the *centre of the earth* would be opposite to what it is on the surface near the equator.

The reason of the terrestrial magnetic influence being so great in soft iron is no doubt due to this metal's great capacity for atomic polarity (compare Tyndall's "Atomic Poles" in the "*Forms of Water*," p. 32) the molecules arranging and disarranging themselves instantaneously, according to prevailing magnetic or electric currents; steel being harder, the molecules do not so easily give way; but when arranged in a manner most favourable to a current's passage, they are more likely to remain so (Coercive Force.) Consequent points in a magnet are due to faulty magnetisation; the bar being touched wrongly, currents in opposite directions are formed and consequently intermediate poles. When the pole of a weak magnet touches the same pole of a strong one, the current in the former may be reversed by the more powerful current of the stronger magnet in an opposite direction, and therefore also the poles of the weaker magnet would be reversed; lightning may cause the same effect.

6.—*On the Coincidence of Periodical Maxima and Minima of Solar Spots with similar changes of Terrestrial Magnetic Variation.*

It is a fact well established by the labours of Schwabe, Wolf and others that in mean periods of about eleven years the number and size of solar spots are subject to gradual changes; while Sabine, Hornstein and Lamont very early discovered a parallelism between these changes and similar ones of the terrestrial magnetic elements; both increase during about $5\frac{1}{2}$ years, when they attain their maxima and then decrease again until they attain their minima together; therefore it has been supposed by many competent authorities that terrestrial magnetism must be influenced by a maximum or minimum of solar spots. I think it more likely, that both phenomena are independent of one another, but since they do coincide, that they must be caused by the same means, for the following reasons: Considering solar spots first, we must bear in mind that the sun

is a fiery mass in the process of cooling, the same as the earth has been in former ages. The spots are products of this cooling process, partly in the solar atmosphere (solar vapours composed of various elements condensed to solar clouds); partly floating on the surface like floes of ice upon water; or in the case of the earth's earlier age, like what then must have been the first nuclei of the forming solid crust (now primary rocks?); these slakes given, they may burst by contraction, the fiery liquid springing up between the pieces, separating and flooding them, or the pieces perhaps may sink into the fiery deep below and become melted again, after which the radiation of heat into space (temporarily suppressed by the intervening spots), will be renewed with increased force. But it would be out of place to discuss here the various theories of solar spots; my object only is to remind that they are a product of a cooling process upon the sun; this cooling process can solely occur by radiation of heat from the sun's surface into space; therefore, if this process appears enhanced during about 5½ years, it is a direct proof that during this period the sun gradually becomes surrounded by a better heat conducting medium; this medium being the assumed allpervading universal ether, without the existence of which neither the phenomena of heat and light nor probably those of gravitation, magnetism, electricity, (and possibly those of sound) could not be explained. But since this heat conducting medium naturally must remain one and the same (the assumed ether), the change or improvement which takes place can only occur in its constitution, and I consider it possible, that during one-half of the 11 years' period its density may increase, during the other half it may decrease; during the dense ethereal periods the radiation from the sun becoming more intense, the superficial parts of the sun cool more rapidly and the maxima occur; during the rarified ethereal periods the radiation decreases, the sun's proper heat melts the products of the preceding accelerated cooling process more quickly than they can be replaced, and a minimum of spots occurs.

That during a maximum of solar spots a maximum of heat is radiated from the sun perhaps may be considered as proved by the discovery of Lockyer, that during a maximum period of solar spots the quantity of rain upon our planet is considerably more than during a minimum of spots; (compare "Kos-"mologische Briefe von Hermann J. Klein, Graz 1877," page 252); because more rain cannot fall, unless more water is previously evaporated from the sea; but more water cannot be evaporated, unless more heat is supplied by the sun, and more

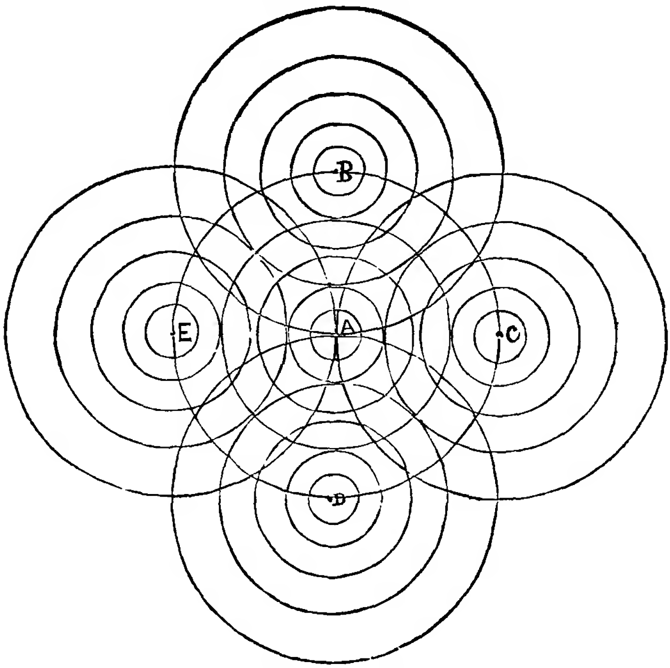
heat cannot be conducted from the sun to the earth, without the capacity of the conductor, the ether being improved; therefore the density of the ether must be subject to periodical changes corresponding to those of the solar spots, and how that is likely to effect terrestrial magnetism we shall see presently, but consider first, how this change of density possibly may happen.

If our imagination and theories fill endless space, where everything is subject to eternal motion, with assumed universal ether, we have no right to suppose that it should not participate in the motion of the stellar systems; and since all its known actions, as transmission of heat and light, are undulatory, then periodically ethereal waves of greater and lesser density may be sweeping through our planetary system, from worlds beyond and towards worlds beyond, perhaps analogue to swarms of meteorites, radiating in certain periods from certain points of the firmament; this ether being possibly not only the element in which all stellar systems are moving, but also the element, the force, by which they are being moved; for I think the possibility can be shown that the supposed ether may be the source of gravitation, the very thing which keeps the atoms of all matter near one another, leads or attracts them towards each other, and in solids, cements them together.

There is a high degree of probability that the ether filling the space of our solar system be moving round the sun in the same manner as the planets; because if the space were filled by the bodies of the system in former ages (dissolved as we might say in ether), as nebulous mass, concentrating afterwards into the various celestial bodies *rotating round the sun in the same direction*, what inducement could the ether have to do anything else?* But ours is not the only solar system in space; ours is surrounded by innumerable neighbouring ones, each possessing no doubt its own revolving ethereal atmosphere. Now, the ethereal undulations from one system must be traversing the undulations of the other systems; because if not, we would simply not be aware at all of the existence of other worlds; and that, when two or more crests of ethereal waves are co-existing (overlapping, superposing one another) in our solar system, the maximum influence of ether is manifested by increased radiation from the sun and consequently more considerable formation of solar spots and greater intensity of all terrestrial phenomena connected with the same pe-

* "Olbers maintained, that this fluid could not be at rest, but must "rotate directly round the sun." (Humboldt's Cosmos, vol. III, p. 48).

riod. But when the troughs of two or more ethereal waves occur together, then the intensity of all phenomena concerned will be less, analogue to the interference of light and other waves; this interference of ethereal waves would be acting on our system like bellows on a furnace, and from other stars possibly our sun might appear as a star of periodically variable light; or perhaps we may view our dense ethereal periods as the sum or accumulation of ethereal waves from the myriads of stars and nebulae in the milky way; or as waves overtaking or meeting the sun on his presumed passage through space. It may be remarked here that the mean periods of about 11 years are by no means very regular; (compare the tables in Dr. Klein's "Kosmologische Briefe," 2nd edition, page 220.)

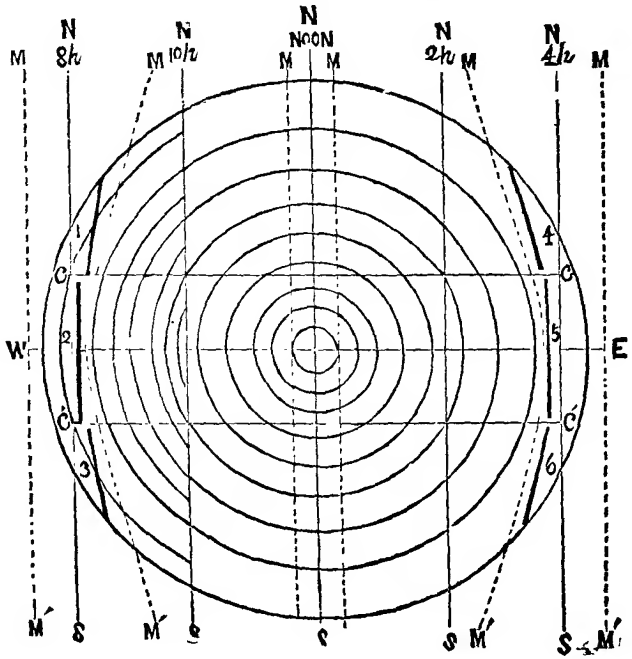


A is the solar system in space; B, C, D and E are to represent neighbouring stellar systems, and the circles ethereal undulation crests; where they coincide, maxima of density take place; where the intermediate spaces—the troughs—coincide, minima of density will happen.

How ethereal waves, therefore also maxima and minima of density, may affect the phenomena in question is well suggested by Alex. von Humboldt, in the English edition of his Cosmos, translated by E. C. Otté, London, 1868, Vol. III, pages 39 and 40:—

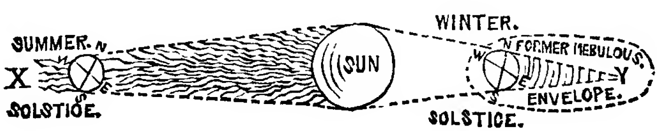
"The numerous investigations that have been made in re-"cent times regarding the intimate relation between light, heat, "electricity, and magnetism, render it far from improbable "that as the transverse vibrations of the ether which fills the "regions of space give rise to the phenomena of light, the "thermal and electro magnetic phenomena may likewise have "their origin in analogous kinds of motion (currents). It is "reserved for future ages to make great discoveries in refer-"ence to these subjects." . . . .

"If electricity moving in currents develops magnetic forces, "and if in accordance with an early hypothesis of Sir William "Herschel, the sun itself is in the condition of "a perpetual "" northern light." (I should rather say of an electro-magne-"tic storm), we should seem warranted in concluding that so-"lar light, transmitted in the regions of space by vibrations of "ether, may be accompanied by electro-magnetic currents."



In preceding figure W E is the terrestrial equator, C C is the tropic of Cancer, C′ C′ the tropic of Capricorn, N S are meridians from 2 to 2 hours; for the sake of simplicity and facility of demonstration we consider these meridians also as magnetic ones; the dotted lines M M′ are to represent the magnetic curves of force between the two hemispheres, according to the theory deduced in the preceding chapter; the circles are intended to denote waves of luminiferous ether striking the equator at noon during the equinoxes immediately below the sun; the effect would be the following: under the sun the supposed lines of magnetic force being struck under a right angle can deviate neither to the eastward nor westward and no diurnal variation will shew; but to the right they would be slightly deflected by the circular (or rather spherical) solar waves and the magnet at 4 (having the tendency to remain parallel to the lines of magnetic force), would show westerly diurnal variation; at 6, easterly, and at 5, none; to the left the magnetic curves of force would be deflected the opposite way and more powerfully so, because the ethereal undulations moving with the sun from E. to W. would act on the lines of force like a vessel's bows ploughing through the seas, throwing up other waves in advance; and a magnet at 1 would shew easterly, another one at 3 westerly, and one at 2 no diurnal variation.

During the summer solstice the same phenomenon would take place at C C, during the winter solstice at C′ C′, thus accounting for annual variation and why there should be a zone near the equator, which alternately, according to the declination of the sun, exhibits the phenomena of the northern or the southern hemisphere.



In the above figure to the left is the earth at the summer solstice, and the undulatory lines connecting the earth with the sun are to indicate ethereal waves, encircling the earth by inflection round it, converging near the hour angle of 12 h., like a divided stream under the stern of a vessel at anchor, producing the second tidal wave of diurnal magnetic variation.

In former ages when the earth was a nebulous mass, comparable almost to ethereal matter itself, these undulations (or radiations?) may have carried nebulous substance along with them towards a point X, and during the winter solstice towards a point Y, forming a conical tail (like a vortex) in the direction of the radius vector, as is still the case with most comets. Now if these ethereal undulations can be allowed as producing diurnal and annual variation, it is easy to see how greater or lesser density of the ethereal medium will influence magnetic variation in the same periods with the greater or lesser frequency of solar spots.

It will be noticed that this is the 3rd suggestion advanced to account for diurnal variation; the first was displacement of the earth's internal magnetic nucleus; the second was tidal motion of the earth's fluid interior; I would be most in favour of this last explanation, provided the regular turning hours of daily variation are not subject to secular change.

The various calculations introduced in several places of this essay are only to answer the same purpose as the diagrams, which are grossly exaggerated to make them more graphic; they are intended to illustrate the principle and nothing more; the data for correct calculations not yet being given, which is much to be regretted.

Humboldt says in the Cosmos that the African node (point of intersection between geographical and magnetic meridians), has been advancing to the westward, rather less than half a degree annually, and he thinks that the magnetic North Pole might be moving from west to east, the South Pole from east to west; in the Admiralty Manual it is stated that the system of magnetic lines in the northern hemisphere appears to be moving to the westward, in the southern hemisphere towards the eastward. My opinion still is, after reconsidering carefully the limited material which gradually has come under my notice while writing these several chapters, that both magnetic poles are moving from east to west, about half a degree per annum, more or less; possibly the southern one somewhat slower than the northern one, for reasons stated in a previous chapter of this appendix.

The magnetic North Pole of the variation charts for 1860 is still placed in the same position, where Captain Ross found it 1830, though I believe in 1860, it must have been from 12° to 15° more to the westward, and perhaps it would be more practical and useful to verify its position from time to time, than to be struggling in vain after the geographical pole.

If I dare to bring this Essay before the public in spite of its imperfections and many shortcomings, it is because I cherish the hope, that some more competent authority, commanding more information, leisure, and means, than myself, might undertake and succeed to sift the erroneous from the truth, to make the latter more readily acceptable.

Note.—Dr. Herman J. Klein states in his "Kosmologische "Briefe ueber die vergangenheit, gegenwart und zukunft des "weltbaues," Graz, 1877, p. 252-253, that Zoellner tried to show the casual connection between the variations of terrestrial magnetism and the state of the sun's surface, while Hornstein at the same time demonstrated, that declination, inclination and horizontal intensity are subject to periodical changes of 26.33 days' duration, and that they can only be considered as caused by the rotation of the sun; from this period the sun's true rotation would be found to amount to about 24.55 days, as deduced by Spörer from direct observations of the sun's equatorial zone.

If this influence of the sun's rotation can be accepted as existing, than it would prove that the magnetic axis of the sun does not coincide with his axis of rotation, (analogue to our planet), and during one half solar revolution one solar magnetic pole would present itself to the terrestrial magnetic apparatus, repelling the latter's pole of the same name and attracting the opposite one; during the other half solar revolution attraction and repulsion of the terrestrial poles would of course be reversed, the whole phenomenon becoming rather complicated by the earth's daily revolution, its changing distance from the sun and the latter's changing declination. Admitting that the earth be influenced by magnetism from the sun, than we must also admit, that the earth by its revolution across the field of solar magnetism may generate electric currents (atmospheric electricity, etc.) analogue to revolving metal and other bodies across the field of terrestrial magnetism (compare Deschanel's Natural Philosophy, by Professor J. D. Everett, London 1873, pages 759-760); but then the interesting question presents itself: why should the sun's magnetic axis not coincide with the axis of rotation? perhaps the answer might be that the sun's magnetic axis has the tendency to set at a right angle to the plane through the centre of gravity of the whole solar system, the latter differing, according to Laplace nearly 1° 34′ 15″ from the plane of the ecliptic, and the plane of the ecliptic forming an angle of about 7° with the plane of the sun's equator. Another interesting question would be: "are the magnetic poles of

"the sun of the same nature, as the corresponding ones of the "earth and other planets, or are they opposite?"

Note.—Since the manuscript has been returned to me, to see the proofs of the woodcuts, I have had the good fortune of reading Sir W. R. Grove's Correlation of Physical Forces (London 1874), in which on page 122 the following passage occurs, which I consider highly corroborative of my views of universal ether: "Ether, which term we may apply to the highly attenu-"ated matter existing in the interplanetory spaces, being an "expansion of some or all of these atmospheres"—(of the sun and planets, etc.)—"or of the more volatile portion of them, "would thus furnish matter for the transmission of the modes "of motion which we call, heat, light," etc.

The same eminent philosopher says in the just mentioned work, page 197: "If magnetism be, as it is proved to be, con-"nected with the other forces or affections of matter, if elec-"trical currents always produce, as they are proved to do, lines "of magnetic force at right angles to their lines of action, mag-"netism must be cosmical, for where there is heat and light "there is electricity and consequently magnetism. Magnetism "then must be cosmical and not merely terrestrial. Could we "trace magnetism in other planets and sun's, etc., it would be "a great step. . . . Mr. Airy suggests that currents of "magnetic force having reference to the solar hour are de-"tected, and seem to produce vortices or circular disturbances "and he invites further co-operative observation on the sub-"ject, one of the highest interest, but at present remaining in "great obscurity."

"Messrs. De la Rue, Stewart and Loewy were publishing a "paper, in which a new theory of sunspots is discussed.—In "this paper all differences of luminosity on the surface of the "sun are referred to the same cause, namely, the presence to "a greater or less extent of a comparatively cold absorbing "atmosphere. (Guillemin's "The Heavens," p. 44.)

The Sun's Atmosphere.—"It is not at all unlikely, that it "may even turn out to have no upper limit, but to extent from "the sun indefinitely into space."—(Ibid, p. 49.)

RETROSPECT AND CONCLUSION.

It may not be out of place at the close of these chapters briefly to review the main features of the theory as follows:—

Revolution of the magnetic poles round the geographical one in about (roughly speaking) $\frac{3}{4}$ of a millennium, probably in an epicycloidal track from east to west.

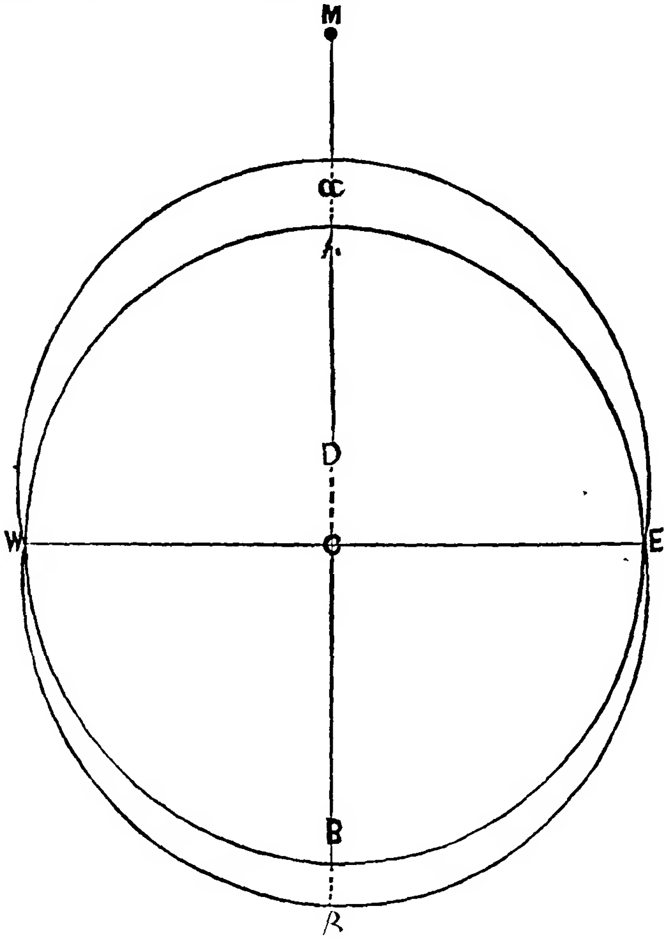
The revolution of poles is brought about similarly, as the westward tendency of the exterior ocean by the mutual attraction between the celestial bodies and the earth's interior fiery fluid conjointly with the quotidian revolution;—the liquid portion of our planet revolving slightly slower than the solid, amounting perhaps to about $\frac{1}{2}$ degree per annum.

The internal fiery fluid contains a nucleus of great density (owing to the stupendous effect of superincumbent pressure by gravity),* therefore of great magnetic capacity and coercive force, as must be inferred from Faraday's and Harris's experiments; Dr. Joule says "that steel would be compressed to $\frac{1}{4}$ of its volume at the centre of the earth." To this extremely dense, perhaps even solidified nucleus, we must look as the seat of terrestrial magnetism, round whose poles all magnetic matter collects like a liquid armature; its axis does not coincide with the axis of rotation, because again owing to the mutual attraction of the heavenly bodies and that part of the terrestrial spheroids internal molten mass, contained in the protuberance at the equator, causing a circuit of current in the fluid interior, which tends to elevate the axis of the nucleus at a right angle with the ecliptic; this tendency conjointly with the daily revolution results in an eccentric circulation of current containing the magnetic nucleus; the strength of current being influenced by aphelion and perihelion, apogee and perigee, opposition, conjunction, quadrature and declination of the celestial bodies; an unequal power of attraction being brought to bear at different times on different portions of the current, is likely to cause irregularities in its shape and motion, to which of course the liquid armature must accommodate itself, causing thereby an unsymetric distribution of the magnetic foci of unequal force; and possibly even a retardation of motion of the magnetic south pole, which irregularities are reflected by corresponding ones on the surface of the planet in the system of magnetic lines, although the latter no doubt are partly also due to the configuration of land and sea, and to the projection upon an ellipsoidal surface from an eccentric internal position.

Annual and diurnal variation are supposed to be caused by

* "It has been computed at what depth liquid, or even gaseous "substances would from the pressure of their own superimposed strata, "attain a density exceeding that of Platinum or even Iridium." (Humboldt's Cosmos, vol. I., p. 163.)

the magnetic nucleus describing a circle round its mean daily position during a revolution of the planet in the opposite direction (which former movement the magnetic poles of course must follow) in the following manner:—



Let A E B W be the earth and M the power of attraction of the celestial bodies at new moon, which will attract A most, C less, and B least; the formation of the flood wave, W a E is

the consequence, which de facto makes the terrestrial hemisphere W A E lighter, than the opposite one W B E ; to restore the centre of gravity of the whole globe W A E B, some contents of the planetary shell must move and the centre of the nucleus is transferred from C to D; now if B has been attracted towards C by a centipetal force proportional to $(B\ C)^2$, then after the transfer of the nucleus from C to D, the point B must be attracted inversely less, as the square of the distance $(B\ D)^2$ has increased; the consequence of this will be the movement of B to β, and the formation of the second flood wave W β E ; or supposing the excess of attraction exercised by M upon the hemisphere W A E equal to a power capable of lifting one million of tons, than $\frac{1}{2}$ million tons of matter must shift from the hemisphere W B E into the former, (or the nucleus from C to D), to restore the disturbed equilibrium of the whole. The earth revolving from west to east and D, having the tendency to remain in the direction of strongest attraction M, must describe a circle in the opposite direction; at other times than new moon, the nucleus would be moved by the parallelogram of forces of solar and lunar attraction.

From this it would appear that the centre of gravity of our planet were not geocentric, an occurrence which will seem less strange (besides the reasons already mentioned), if we consider the fact that even the position of the central body of the whole planetary system is not always in the mathematical centre of the latter, "but it actually rotates round the common centre of "gravity of the system, which occasionally falls within itself, "that is to say, remains within the material circumference of "the sun," (Ottes, Eng. transl. Cosmos, Vol. I, page 134) and "in September 1827, Schwabe discovered the eccentric posi-"tion of Saturn, afterwards confirmed by Harding, Struve, "Herschel and South," (ibid, Vol. IV, 521). Anyone acquainted with electric phenomena will conceive, that by such motion and commotion within the earth, electric currents should be generated, which joined to the probable magnetic capacity of the nucleus, will easily account for the existence of terrestrial magnetism; electric knowledge "has also thrown much light on the "internal action of terrestrial forces, since magnetism has been "recognised as one of the simplest forms under which electri-"city is manifested" (ibid, Vol. II, 727).

The description of magnetic currents given in the 5. Chap. of the Appendix as a peculiar solenoid-like closed circuit, well explaining all magnetic phenomena, I think not undeserving of

oonsideration, and it would be interesting to learn, if my view f tidal motion could be confirmed (4. Chap. Appendix.)

In the Journal of the North-China Branch of the Royal Asiatic Society, new series, No. X, Shanghai 1876 (Appendix II) some highly interesting remarks are contained by the Rev. Father M. Dechevreus, S. J.: "J'ai tout dernièrement reconnue que ces briques" (some building material used at the Zi-ka-wei observatory, nearly four miles from Shanghai), "provenant du Tché-kiang, sont notablement magnetiques (celles "qui viennent de Tien-tsin ou du Tché-ly le sont au même de-"gré) et que la correction à apporter à ces dernières observa-"tions est assez forte." . . . .

"Pendant la nuit le mouvement de l'aiguille, chaque fois que "j'ai fait des observations de 24 heures, a éte excessivement "faible et difficile à saisir avec le déclinomètre;" (this would appear favourable to the view attributing diurnal variation to thermo-electricity by the sun, but Humboldt and Sabine assert, that it makes no difference in the daily turning hours, whether the sun rises very early in summer, or very late in winter; therefore I beblieve my suggestion of ethereal waves in the last chapter of the appendix a more likely explanation), In another place the able Zi-ka-wei observer states: "la declinaison mag-"nétique à Zi-ka wei en 1874-75 aurait en moyenne, dans l'in-"tervalle de 24 heures presente 3 minima orientaux et 3 max-"ima occidentaux." . . . .

"Telle est la marche générale du phénomene; en hiver le ma-"ximum du matin se présenté après 6 h.; de même le mini-"mum du soir se rencontre avant 5 h.; de telle sorte que dans "l'intervalle de 12 heures, on peut observer dans la courbe "semi-diurne deux minima et deux maxima; bien plus j'ai été "assez étonné plusieurs fois," (on full and change of the moon ?), "entr'autres jours le 6 Fevrier 1875" (new moon about 4 p.m.), "de constater l'existence, dans le même intervalle de "temps, de trois mouvements complets de va-et-vient très-bien "marqués et presque d'égale amplitude;" are these daily fluctuations indicative of the 3 distinct influences by circular motion of the nucleus, by the daily ethereal flood wave (Chap. 5., Appendix), and by the internal tides of the molten mass (Chap. 4., Appendix), the latter dependent on a "subterranean es-"tablishment of the port" ?

Humboldt, to whom the science of terrestrial magnetism owes so much, repeatedly suggests various plans for investigating thoroughly these interesting and important phenomena, a correct knowledge of which is of consequence in surveying, en-

gineering, mining, travelling, strategy, etc.; but to no one more than the navigator, the shipowner and insurance companies especially since the large introduction of iron and steel into' ship building.

The fragmentary character of these pages is due to their being written at different periods of the present S. W. monsoon (1878), as the necessary information, however, scanty, gradually became procurable, and without the valuable assistance of the gentleman already named, and the kindness of the president, secretary and council of the N.-C. B. of the R. A. S. I would not have been enabled now to submit to the test of public discussion and criticism this essay on *Periodical Change of Terrestrial Magnetism.*

SECOND APPENDIX TO PERIODICAL CHANGE OF TERRESTRIAL MAGNETISM.

Various Supplementary Remarks.

Regretting not to have been able to introduce the following remarks in appropriate places of the various preceding chapters, I must apologize for intruding them now; but I could only lately write them, after the works quoted had come into my possession from the estate of a distinguished and much lamented late member of the N.-C. B. of the R. A. S.

In the journal of the latter Society, No. 2, May 1859, page 222, Captain (Vice-Admiral Sir Charles) Shadwell, C.B., H. M. S. *Highflier*, states from personal and Sir Everard Home's observations that in Singapore, Hongkong, Shanghai and adjacent places the dip (inclination) of the magnetic needle is increasing and says page 224 "all these changes can be accounted for on the supposition of a gradual increase in the amount of the vertical component of the magnetic intensity of those places."

I beg leave to point out how the increasing magnetic dip in question is explainable by the theory which I have had the honour of bringing before the same Society. Captain Ross found the magnetic North Pole, A. D. 1830 at about 97° west of Greenwich=141½° east of Shanghai; allowing about ½° westerly motion per annum would have placed the same pole for the year 1753 in 58½° west of Greenwich, i.e. on the meridian of

Shanghai *below* the geographical North Pole, when the dip at Shanghai probably may have been near 40 degrees, because that is the amount roughly, according to the inclination chart of the Admiralty Manual at 180° from the magnetic North Pole in Shanghai latitude, 31° north; and about the year 2113 when the magnetic pole should pass the meridian of Shanghai *above* the geographical pole, the dip will probably be about 60°, because that is at present approximately its amount due south of the magnetic pole for Shanghai latitude.

These suppositions accepted, it would be clear that since say 1753 until about 2113 the dip at Shanghai must be increasing, because the magnetic pole in its secular revolution is approaching the latter place, and the nearer the pole, the greater the inclination of the needle. The same reasoning holds good concerning Singapore, although it has southern inclination; the magnetic pole to the southward of Australia in its westerly motion is approaching the meridian of Singapore, therefore the dip must increase. Sir Charles Shadwell also calls attention to the anomaly, that at Woosung, 10 miles to the northward of Shanghai, the dip on the 26th November 1858 was 45° 2′ north, 16-17 minutes less than at the latter place on the 10th of June (45° 18′ N.) and on the 16th December (45° 19′ N.) Consulting the same Society's Journal, new series, No. X, 2nd Appendix, Shanghai 1877, it will be found that on the 3rd October 1875 the dip at the Zi-ka-wei observatory was 46° 26′ 15″ north, and next month 21st November 46° 9′ 38″ north; the actual greatest difference may probably have escaped observation, because unfortunately for 1875, from April to December, only 34 observations are recorded; the amplitude of horizontal variation, more extensively observed, has certainly been greater; for the Rev. Pere M. Dechevreus, S.J., states in the same place the greatest difference to have been 21.51 minutes. From this great difference at one and the same place in less than two months' interval it appears doubtful, whether the anomaly pointed out by Sir Charles really does exist, or whether it has been only accidental; the same remark applies to the observations at Kintang and Ningpo of the same paper.

There is always a fleet of native and foreign men of war in the port of Shanghai; there is a harbour master's station and a telegraph office now at Woosung; might it not be possible to make arrangements for taking a series of dip observations near Woosung, simultaneously with the Rev. Jesuit Fathers at the Zi-ka-wei Observatory, to discover the true state of the magnetic elements in the vicinity of this influential emporium of cos-

mopolitan enterprise? It is of interest and importance to study the variation of the magnetic elements in these parts of the world, in order to understand the nature of that peculiar oval of western variation, in which Shanghai is situated, and which, judging from Bohn's edition of Humboldt's Cosmos, Vol. I, pages 174-175, at Columbus's time must have been in the North Atlantic between the Azores and the shores of the new continent: "We can with much certainty fix upon three places "in the Atlantic line of no declination for the 13th September "1492, 21st of May 1496 and the 16th of August 1498. The "Atlantic line of no variation at that time ran from N. E. to "S. W."—(corresponding to that portion of the *oval* now between the Philippine Islands and the Pacific Ocean to the eastward of Japan,)—it then touched the South American continent "a little east of Cape Codera," etc.,—which latter line may have been the one now passing through Australia. Too much reliance, however, cannot be placed on those early observations, either european or oriental, for on page 175 of the same volume we read that in Paris 1669 the variation was null, while other authorities give the year 1663; on page 174 we find on the 13th September 1492 the "line of no variation was "3° west of the meridian of the island of Flores"—and in the Vth Volume of the same work, page 54, we see that the same line on the same date was $2\frac{1}{2}°$ east of Corvo, Azores Islands. It is therefore all the more an important duty for the present generation to investigate the magnetic changes more minutely. From Columbus' time to its present position this interesting oasis of western declination would have performed about half a revolution round our planet from east to west in somewhat more than three centuries. Humboldt suggests repeatedly various plans for discovering the true state and nature of terrestrial magnetism; the best proceeding perhaps would be, to establish an international commission by special delegates from all civilized nations, to ascertain four or five times every century by numerous land and sea expeditions after well concerted plans the exact state of the magnetic elements all over the globe, in connection with the fixed magnetic observatories already existing; the expenses to be borne proportionally by all governments concerned. In Vol. II, No. 1 of this Society's Journal, Shanghai 1860, page 95, a supplementary memorandum by Admiral Shadwell is contained with some additional useful information concerning the magnetic elements in these regions, and I am confident, that by some more reliable observations taken in the present century the westward move-

ment of the ellipse of western declination in eastern Asia can be proved.

In No. XI of the same Society's Journal, Shanghai 1877, in a paper by Dr. J. Edkins "On the Variation of the Compass as "observed in China in the VIIIth, IXth, XIth, XIIth and XVIIth "Centuries," much valuable information is contained. Dr. Edkins says, page 140, that Mr. Wylie cited a passage from Su-kwang-ki, which states: "there is a variation for every "place. In Peking the variation is 5° 40′ east; this is found "in his work Li-yi;" page 139: "hence we learn that the va-"riation was eastern in China in A. D. 713 and at about A. D. "900. After that it became western and was so about A. D. "1080 and nearly a century later, at the time of Lai-wen-"tsiun." Dr. Edkins thinks, that since the Tang dynasty the needle may have had western declination and exchanged it again for eastern, two or three times. "Shen-kwa is quoted "as saying that in the place where he was writing the needle "persistently pointed to *ping-wei*. Transferred to our compass "this is the same as 15° to the west of north." From a remark on page 142 it seems that in 1080 and 1160 the variation in China was westerly, 7½° in the latter year.

Dr. Edkins arrives by means of Ganot's Physics, translated by Atkinson, at the same conclusion, to which I have been led by Muller-Pouillet's work. It may not be uninteresting to reproduce here, from the transactions of the China Branch of the Royal Asiatic Society, part 1st, Hongkong, 1848-50, p. 163, the following curious precept for magnetisation from the Chinese cyclopædia Tung-teen-shaou, as extracted by Dr. W. A. Harland:—

"*To make Needles point to the South.*—Take of vermillion, "orpiment and iron filings of each several fun (one fun equal "to 6.4 grains avoirdupois), reduce them to an impalpable pow-"der, and mix together with blood from the comb of a white "cock. Twenty or thirty needles are to be mixed up with this "composition, well folded in paper and placed in a furnace "where they are to be exposed to the highest heat of a char-"coal fire for seven days and seven nights. They are then to "be taken out and folded up in a piece of flesh for three days, "after which they may be removed and placed on the surface "of water to ascertain whether they turn towards the south "and are fit for use." Iron possessing the greatest magnetic capacity, when red hot, it is not impossible that the needles may acquire magnetism by induction from the earth, especially if placed parallel to the magnetic dip, which induced magne-

tism may become permanent, if the needles by the described procedure, (brisk insertion, whilst hot, into flesh), have become hardened, converted into steel. The Chinese do not seem to have discovered the magnetic inclination. It appears, that the manifestation of magnetism is more dependent on the extent of surface, than on the mass of magnetic bodies; an empty iron tank, for instance, according to Commander W. Walker, R.N., exercises the same influence on a compass, as a solid mass of iron of the same size; therefore it may perhaps be possible to give a greater directive force to the mariners' compass card by using hollow magnets in its construction, thereby increasing the magnetic surface of the apparatus, without increasing its weight.

The importance of the superficial area of magnets is further illustrated by the fact that several magnets closely joined together to form a magnetic battery, possess less magnetic intensity, than the sum of intensities of the individual magnets would amount to; simply because the battery exposes and affords less surface to the display of magnetic currents, than the surfaces of the single magnets amount to, when separated. Perhaps some desirable information concerning local magnetic changes can be derived from Japanese or Dutch authors, on account of the latter's early connection with Japan and Formosa; instructive records of these phenomena in China and Japan may also be contained in the Portuguese and Spanish archives in Macao and Manila. The following series of magnetic observations in the vicinity of the head quarters of this Branch of the R. A. S., Shanghai, are by high authorities, and extracted from the Society's Journal:

June 1843, dip by Sir E. Home, 44° 75′ N.

June 1858, dip by Sir C. Shadwell, 45° 18′ N.; declination, 2° 29′ W.—Race Course.

June 1858, dip by Sir C. Shadwell, 45° 19′ N.; declination, 2° 32′—Consular Flagstaff.

A. D. 1875, dip by Father M. Dechevrens, 46° 15.8′ N.; declination, 1° 59.82—Zi-ka-wei.

A. D. 1874-1875; intensity, horizontal, 6.94867; vertical, 7.25868. Total, 10.04850.

In Deschanel's Natural Philosophy by Professor Everett, London 1873, page 633, the following passage occurs: "As to "dip, its amount at Paris has continued to diminish ever "since it was first observed in 1671. From 75° it has fallen to "66°, its present value. As its variations since 1863 have been "scarcely sensible, it would seem to have now attained a mi-

"nimum to be followed by a gradual increase." By an inspection of the figures on page 631 of the same work, it will be remarked that the isoclinal lines form more or less regular ellipses round the magnetic poles, which in several parts of their configurations almost coincide with the parallels of latitude for some distance; such a coincidence of secular motion has probably happened in 1863 at Paris, when the dip will appear stationary for some time. A similar thing may happen in regard to the *western declination in China*; the greater axis of the oval running north and south, the northern and southern parts of the oval isogonic lines will nearly coincide with the parallels of latitude, and when the maximum of western variation is reached at any place it will remain stationary for some time, and then it will decrease. This hypothesis applied to the above table from the Society's Journal, it would appear, that since Sir Charles Shadwell's observations of the declination the north and south axis of the oval must have been passing towards the westward.

According to the international code of signals, London 1877, page 233, the magnetic declination has decreased about a quarter of a point during the last fifteen years in England. By a careful perusal of the Admiralty Manual of Scientific Enquiry, London 1871, my opinion concerning tidal motion appears confirmed by the following sentences: "With regards "to the stream of flow and ebb, they are often not merely two "streams in opposite directions at different times of the tide; "they generally turn successively into several directions, so as "to go quite round the compass in one complete tide, either in "the direction N. E. S. W. with the sun"—(in places to the northward of the sun?)—"or N. W. S. E. against the sun," pages 71-72—(in positions to the southward of the sun?)—"In "all land areas in the northern hemisphere the wave of high "water tends to revolve round the coast in the direction of the "hands of a watch and in like areas in the southern hemis- "phere against the hands of a watch; leaving out of the ques- "tion the theoretical (Mr. Carrick's) considerations, on which "are based these results, the degree of truth contained in the law, "regarded merely as empirical, *is worthy of very severe scrutiny.*"

Much less appears actually to be known yet of tidal movements than is generally supposed; "the general progress of the "tide wave along even the most frequented shores is still im- "perfectly known; and about the connection of the tides over "the general areas of large oceans we are as yet entirely in the "dark; there is therefore an ample field of important and use-

"ful discovery in this subject," (page 78) and "in the central "parts of the Pacific the tides are small and anomalous, for "they do not clearly depend on the moon," etc., etc. It is possible, that the last mentioned phenomenon may be due to the very probable fact, that the earth's solid crust covered by the Pacific may be thinner, than at other portions of our planet and therefore the outer crust, ocean and interior fiery fluid matter *together yielding more equally* "to the deforming influences of "centrifugal force and the attraction of sun and moon," (Mr. Kingmill's Borderland of Geology and History, page 5), which would certainly have the influence of letting the oceanic tides appear "small and anomalous."

The same remark applies to Batavia; "by accurate observ-"ations made in 1839 at Onrust, it seems that the tides and "rise and fall are not subject to fixed rules. The mean rise "and fall was two feet, and the maximum and minimum four "feet." (Findlay's Sailing Directory for the Indian Archipelago, China and Japan, London, 1870, page 613.)

I must acknowledge with thanks that I have been under obligation, when writing this second appendix, to the kind assistance of Mr. John Christie, chief engineer of the China Navigation Company's steamer *Chefoo.*

After the above lines had been sent to press, I have been favoured by the urbanity of the talented and zealous director of the magnetic and meteorological observatory at Zi-ka-wei, the Rev. Father Marc Deehevrens, S.J., with his reports for 1876-77 and a general resumé for 1878, from which the following facts are extracted:—

	1876	1877	1878
Declination	2° 1′ 24″ W.	2° 1′ 21″ W.	2° 0′ 04″ W.
Inclination	46° 13′ 43″ N.	46° 13′ 38″ N.	40° 13.4′ N.
Horizontal } Compo-	6.95131	6.9637	6.9770
Vertical } nent ...	7.25602	7.2684	7.2815
Total Intensity......	10.04924	10.0656	10.0846

The learned and Reverend Father states in regard of the mean values for the inclination and intensity in 1878 that during the months of May and June the observations had to be interrupted: "les travaux d'agrandissement de notre salle

"magnetique m'ont forcé à interrompre les observations direc-"tes d'inclinaison et d'intensité."

In his "Bulletin des Observation de 1876" Father Dechevrens describes an ingenious apparatus in use at Zikawei; "cet appareil à lui seul pourra, avec un chronomètre, consti-"teur tout le bagage scientifique et géographique à travers la "province, servant tout à la fois de théodolithe et de boussole "pour l'inclinaison, la declinaison et l'intensité magnètiques." If all Meteorological Observatories were supplied with this useful instrument, the mysterious periodical changes of terrestrial magnetism in the Far East would be much sooner revealed indubitably, than can be done by the solitary efforts of a single institution, although the observations be carried on in such a careful, intelligent and skilful manner, as at the excellent Zikawei Observatory; only by many valuable observations in numerous localities and extended over *long periods of time*, this interesting and important problem can be solved; a truth, beautifully illustrated by the Hexameter, which King Ludwig of Bavaria, caused to be engraved near a picturesque waterfall in the Alps:

"Gutta cavat lapidem, non vi, *sed saepe cadendo.*"

I believe I cannot close these pages in a more appropriate manner, than by the remark from the illustrious Humboldt's Cosmos (Bohn's edition, Vol. II, page 720), that "several times "every century an expedition of ships" (in conjunction with the fixed observatories ashore and land expeditions) "should be "sent out to examine as nearly as possible *at the same time* the "state of the magnetism of the earth, so far as it can be in-"vestigated in those parts covered by its ocean. May perma-"nent scientific institutions (Academies) impose upon them-"selves the practice of reminding every twenty-five or thirty "years' governments, favourable to the *advance of navigation*, "of the importance of an undertaking, whose great cosmical "consequence depends on its long continued repetition."

ERRATA.

Page 38—Middle of page read 1663 instead of 1163.
,, 38—21st line from bottom read "minimum" for "maximum."
,, 40—Middle of page read (Celsius) instead of (celsius.)
,, 41—14th line from top read "slag" for "slake"
,, 46—Middle of page read "do not coincide" instead of "does not coincide".
,, 46—12th line from bottom read "diurnal" instead of "diurned".
,, 47—11th line from top read "observatories" instead of "observations".
,, 48—10th line from top read "1841, angle" instead of "1841. Angle".
,, 50—10th line from top read "armature" instead of "armisture".
,, 52— 7th line from top read "elliptic" instead of "ecliptic".
,, 52—17th line from bottom read "full or new moon" instead of "full moon".
,, 56— 6th line from top read "hemisphere" for "hemispheres."
,, 57—13th line from bottom read "Sabine" instead of "Sabini".
,, 63— 2nd line from top read "Gales" for "Galese."
,, 64—16th line from top after "directions" add; *were*.
,, 65— 1st line from top read "current" for "currents."
,, 65— 4th line from top read "similar" for "singular."
,, 65—12th line from bottom read "Sn" for "SN."
,, 67— 7th line from top after "which" add: according to.
,, 68— 6th line from bottom read "Dr. Brünnow" for "Dr. Brunnout."
,, 68—12th line from bottom read "Stromboli, (volcanoe)" instead of "Stromboli (volcanse.)"
,, 69— 6th line from bottom read "relations" instead of "rotations".
,, 69— 9th line from bottom read "statical" instead of "statistical".
,, 69—17th line from bottom read "noyau" instead of "noyan".
,, 69—middle of page read "Biot, Hansteen and others have had."
,, 70— 9th line from bottom read "closer" instead of "closed".

,, 70—The sentence "On the 1st of September," etc. should have been printed as a note to the 6th Chapter of the first Appendix.

,, 72— 5th line from bottom add: "I copy as follows:"

,, 73—17th line from top read "exist" instead of "exists."

,, 85—15th line from bottom read "then" for "than."

,, 90— 6th line from top read "Dechevrens" for "Dechevreus."

,, 90— 7th line from top read "reconnu" for "reconnue."

,, 90—10th line from top read "viennent" instead of "vieunent."

,, 90—21st line from bottom read "presenté" for "presente."

,, 90—18th line from bottom read "presente" for "presenté."

,, 98— 6th line from top read "constituer" and "géographique" instead of "constiteur" and "gêographique."

ARTICLE III.

THE FAMILY LAW OF THE CHINESE, AND ITS COMPARATIVE RELATIONS WITH THAT OF OTHER NATIONS.

By P. G. von Möllendorff, Esq.

THE following essay on the Family Law of the Chinese is the first endeavour to treat scientifically a part of Chinese law. The reason which led me to choose the family law was that in making extracts from Chinese works I found this portion of the law first completed. It may, therefore, serve as an introduction for a work to be compiled, viz., the Laws and the Legal Procedure of the Chinese.

The interesting work (in German) of Dr. Samuel Mayer on the laws of the Israelites, Athenians and Romans has furnished me with many comparisons, ideas and quotations, as have also other works on Roman law. I have in addition, found of considerable use the essays anonymously published in the *China Review*, Hongkong, vol. V. (1877) p. 404-7; vol. VI, p. 64-66.

Some sentences have been taken from Maine's Ancient Law, 6th edition, 1876, and from John Fergusson McLennan's studies in Ancient History, comprising a Reprint of Primitive Marriage, an Inquiry into the origin of the form of Capture in Marriage Ceremonies. London, 1876, especially chapter II., p. 13 ss.

I am especially indebted to my friend E. H. Parker, Esquire, of H.B.M.'s Consular Service, for some valuable notes relating to the subject.

Of the extensive Chinese literature on law, I have principally consulted the following works:—

大清律例 *Ta-ch'ing Lü-li*, the statute law and the ordinances of the present dynasty. 40 vols., 1866. The statute laws and some of the ordinances have been translated by Sir G. T. Staunton; see Manual of Chin. Bibliogr. No. 201.

說帖類編 *Shuo-t'ieh Lei-pien*, collection of decisions from the years 1821-34 (Taokwang). 32 vols. 1835. 8vo.

大清律例按語 *Ta-ch'ing Lü-li An-yü*, collection of decisions from the reigns of Yungcheng, Kienlung, Kiaking and Taokwang, 1724-1847. 80 vols., 1847. 8vo.

A manuscript collection in 14 large volumes; containing decisions from the reign of Yungcheng till Hsien-feng (1723-1851), compiled by law secretaries (師爺) of the Governors of Hunan.

Collections like this are extremely rare and valuable.

In the arrangement of the subject before me, I have taken as a basis the Roman law; as owing to its logical structure and general completeness this law has become a typical system, and has formed the foundation of the jurisprudence of all European nations.

TABLE OF CONTENTS.

INTRODUCTION.

The Chinese expression for "family" (家 *chia*) embraces, like the Attic *οἶκος*, all members of the same household, which stand under one head or *pater familias* (家父 *chia fu*), without distinction, whether they have entered the family through marriage or adoption. It is obligatory that all members of the family bear the same family name (姓 *hsing*).[1] Even with adoption a kind of quasi relationship is formed with the acquisition of the clan-name.

At the oldest time of Chinese history the number of families may have been the same as the number of clans;[2] the idea that there exists a kind of relationship between families bearing the same name, has lived to the present time (see below—Impediments to Marriage).

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1 As in India, Greece and Rome, McLennan, l.c., p. 217.

2 S. Wells Williams in his Syllabic Dictionary, p. 1242, dates back the beginning of family names to over 3000 years, without, however, quoting any authority.

A family is founded with the consummation of marriage and the expression 成家 *ch'eng chia* means to marry as well as to found a family.

Within the family the Chinese distinguish four grades of relationship, which follow according to the proximity of descent, without distinguishing thereby between consanguinity and affinity. A genealogical table is given in the 大清律例 vol. I., fol. 1-6.

The slaves are also counted as belonging to the family, and their name 家身子 *chia shen-tzŭ* has almost the same meaning as the Greek *οἰκέτης* (compare also the Latin *familiaris* and the French *maison* with the same sense).

As a relationship is always indicated by having the same family name, it may here be stated that the Manchus, whose emperors have reigned over China since 1644, have not used their family names (姓 *hsing*, Manchu *hala*) since the reign of the emperor Kanghi (1662-1723), but only their personal names (名 *ming*, Manchu *gebu*). The family names are, however, known within the clans, and the law concerning family names is the same for the Manchus as for the Chinese.[3]

A.—ON MARRIAGE.

I.—General.

Marriage is regarded by the Chinese as something necessary and indispensible: and the best proof of this is furnished by the fact that, excluding those of the priests who are not allowed to marry, it is scarcely possible to find a bachelor; and an old maid is an extraordinary rarity. Chinese law further recognises the importance of marriage by giving a long list of marriage laws. We must add, however, that marriage is not absolutely compulsory, nor is celibacy punished, as was the case under Jewish law and the Attic Code of Solon.[4]

The Chinese distinguish between two kinds of marriage which, not uncorrectly, may be termed *connubium* and *concubinatus*. In the first case they are obliged to be content with one wife (妻 *ch'i*),[5] who is chosen by the head of the family from a

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3 See Williams l.c. p. 1243.

4 See Mayer l.c. vol. II., p. 286: Among the Israelites each man was obliged to marry and could be forced by the authorities to fulfil this duty until he had a son and a daughter, compare Pollux III., 48. VIII., 40.

5 Like the Roman law, § 7. J. de nuptiis 1, 10.—L. 2, C. 5, 5.

family of the same position and circumstances. Concubinage is, however, at the same time permitted, and marriage with several concubines (妾 *ch'ieh*) is allowed. The number of these, besides the one wife, is not limited by law, but only one wife is permitted.

Whilst the marriage with the wife (妻 *ch'i*) is concluded by the parents of the two parties, the man is allowed to choose himself the concubines, who may be of low rank, even slaves. The concubines, without regard to priority of marriage, have amongst themselves equal rank, but are subjected to the wife.

The husband has not the right of degrading, without sufficient reason,[6] his wife to the rank of a concubine; nor of raising a concubine to the rank of a wife while the wife is alive.

The wife is considered the mother of all the children born in the family[7]: and the reason for the greater number of marriages with concubines is barrenness of the wife.[8]

II.—Requirements for Concluding Marriages.

a.—Absolute Impediments to Marriages.

The attainment of puberty required by the Roman[9] and the Canon[10] law, or of a certain age, as prescribed by modern legislation, as a pre-requisite for concluding marriage is not known to Chinese law. It is, however, an established custom, that men marry when over twenty years of age, and that girls are rarely given in marriage before their fifteenth year. But as there are many exceptions in the laws for the benefit of persons under fifteen years of age, we may consider the latter as the age required for concluding a marriage. Non-attainment of puberty, disease, or other defects (as insanity, deafness and dumbness, etc.) are considered impediments, if when entering into the marriage contract, no notice had been given of them.

The right of having eunuchs is granted, besides to the emperor, only to the highest members of the imperial family; and

6 See Impediments of marriage.

7 The same in Jewish law, see Mayer l.c. II. p. 339 and in Mohammedan law, see G. Rosen in Zeitschr. d. Deutschen Morgenl. Ges. XXII. (1868) p. 543.

8 Compare the Jewish custom, Mayer l.c. p. 339: as it was considered a disgrace, if a wife had no children, the wife in such case induced her husband to take a maid-servant as concubine, the children born by such concubines were hers, so that she was not childless.

9 Pr. J. de nuptiis 1, 10,—l. 14 D. 23, 1, l.—4 D. 23, 2.

10 Tit. X., 4, 2. Lib. sext. Decretal, 4, 2.

as eunuchs only serve in the palace, it is, for this reason, impossible for them to conclude a marriage.

There exist, however, eunuchs at Peking, who have had children before their castration, and who are allowed to visit their families from time to time. Cases may occur in which an eunuch who, by intrigues in the palace, has arrived at a position of honour may take a wife *pro forma*.[11]

It is forbidden to take a second wife (妻 *ch'i*), as long as the first one is living.

b.—Relative Impediments.

1.—On account of Relationship.

Marriage between relatives of all grades of relationship, is prohibited, no matter whether the relationship be one of consanguinity or of adoption. For the latter, however, in contradistinction to the requirements of the Roman law, the prohibition does not hold good after the first adoption has been dissolved by a new adoption.

It may here be observed that there exists no relationship between the husband and his wife's sister, as is the case according to the canonical and, after it, the English law. Altogether there exists no relationship between the relations of the husband and those of the wife.[12]

In the Institutes of Menu it is laid down that a twice-born man (*i.e.* one belonging to the sacerdotal, military, or commercial class, Menu X., 4) might elect for nuptials "a woman not descended from his paternal or maternal ancestors within the sixth degree and who is not known *by her family name* to be of the same primitive stock with his father." Menu III. sec. 5, in McLennan p. 84. They (the American Indians) profess to consider it highly criminal for a man to marry a woman whose totem (family name) is the same as his own, and they relate instances when young men, for a violation of this rule, have been put to death by their own relatives, *cod.* p. 97.

Relationship is always implied by the fact of having the same family name, 同姓不為婚姻 *T'ung hsing pu wei hun yin* people of the same family name do not intermarry. Considering that for a population of 400 millions only about 350 family names exist, this impediment appears severe in the highest

11 See G. C. Stent, Chinese eunuchs, Journal of N.-C. B. of the R. A. S., Shanghai, 1877, New Series, No. XI., p. 143 ss.

12 As in the Jewish law, see Mayer l.c. II. p. 284.

degree. In the course of ages[13] it happened, that whole communities in China were composed of people who had the same family name; so that men desirous of marrying had to look elsewhere for wives, and had to undertake for this purpose voyages often expensive. An expedient to mitigate this law had, therefore, to be found. During the reign of Yung-lo (1403-25) those families, who took part in the grain transport to Peking, received the name of military families (軍家 *Chün-chia*), the others being called 民家 *Min-chia* families of the people. Since that time the distinction between 軍 *Chün* and 民 *Min* has been maintained and marriages between a 軍 *Chün* and a 民 *Min* family bearing the same family name is permitted as the only exception from the above mentioned prohibition.

2.—On Account of Affinity.

Marriage is not allowed with one's step-daughter, with the father's or the mother's sister-in-law, with the cousin, with the sisters of the son-in-law, or of the daughter-in-law, with the sisters of the grandson's wife, or with nieces.

Further, marriage is forbidden with female relatives outside the fourth degree of relationship,[14] with widows of a relative of the fourth degree or with the sister of the widowed daughter-in-law. Marriages with widows of relatives of a nearer degree are considered incestuous.

Decapitation is the punishment for marriage with the father's or grandfather's former wives, or with sisters of the father. Whoever marries his brother's widow is strangled.[15]

3.—On Account of other Reasons.

To conclude marriage is prohibited during the legal time of mourning. This is

1—	For near relatives of the		1st	degree :	3 years.
	,, other	,,	1st	,,	3-5 months.
2—	,, relatives	,,	2nd	,,	9 ,,
3—	,, ,,	,,	3rd	,,	5 ,,
4—	,, ,,	,,	4th	,,	3 ,,

Marriage with concubines, is, however, in this case not punished, unless either the bride or the bridegroom is in mourn-

13 The prohibition occurs in books as early as the 左傳 *Tso-chuen* and 論語 *Len-yü*.

14 As in canonical law, cap. 8. X, 4., 14, Walter, Kirchenrecht § 310.

15 In contradistinction to the Jewish law.

ing for a parent, or the bride for her late husband.[16] It is considered a time of mourning for children or grand-children if father or mother, or grand-parent is confined in prison for a capital crime. In accordance with the principle of Chinese marriage, that the *pater familias* makes the marriage contract, marriage is in this case permitted, if the head of the family in prison gives his assent. The usual ceremonies and festivities are in such cases to be omitted.

Marriage is forbidden with a woman who has committed a crime and has fled for fear of punishment. In this prohibition is included marriage between an adulteress and her seducer.[17]

Whoever forces the wife or daughter of a free man to marriage, either with himself or with a son, grandson, younger brother or nephew, i.e. with a *filius familias*, is to be strangled.

According to Roman law marriage could not be concluded between persons, who stood to each other in the relation of guardianship, as *tutor* and *pupilla*.[18] In China *tutor* and *pupilla* are near relatives, as only relatives or adoptive parents are able to exercise the right of guardianship and to acquire through it the *patria potestas*. A runaway female slave is not allowed to marry, as she can be lawfully given into marriage by no one except her master.

A widow cannot remarry without consent, as she always remains under *patria potestas* and as somebody is required to whom the purchase money may be paid.

A widow, who has received an imperial reward for her faithfulness to her late husband, is not allowed to marry again.

Officials cannot hold office in their native province, perhaps for the reason that by this measure greater impartiality is secured. For the same reason it is not allowed to them to marry a woman under their jurisdiction, or out of a family that has an interest in the performance of their official duty.[19]

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16 The same in Roman law l. 1, 11 § ult.—l. 12, l. 13, pr. D. 3, 2—const. 2 C. 5, 9. Widows and their new husbands were punished, if remarried before the end of the time of mourning.

17 Also prohibited by Roman law, l. 26. D. de ritu nupt. (23, 2).—l. 13, D. de his quae (34, 9). Nov. 134 si quis autem c. 12,—by Attic law L. 11 § 11. L. 40 D. ad leg. Jul. de adult. (48, 5), and by Jewish law, see Mayer l.c. II p. 320.

18 L. 59, l. 62 § 2, l. 66 D. de ritu nupt. (23, 2), C. 5, 6.

19 A similar thought prohibited in Rome marriage between a praeses provinciae and a woman of his province; l. 57 pr., l. 63 D. de ritu nupt. (23, 2); Cod. Th. 3, 11, Cod. Just, 5, tit. 2, 7.

On account of inequality of rank marriage between officials and actresses and singing girls is prohibited. Such marriages are also forbidden to the sons or grandsons of officials of nobility with hereditary rank *(disparagium, mesalliance)*, the punishment in this case is degradation to a lower class of nobility and eventually loss of nobility.[20]

Buddhist priests (和 尙 *Ho-shang*) and nuns (尼 姑 *Ni-ku*), and those Taoist priests (道 人 *Tao-jen*) and nuns (道 姑 *Tao-ku*) who do not shave their heads, are not allowed to marry. Only those Taoist priests (道 士 *Tao-shih*, also called 門 祝 *Men-chu*), who shave their heads and plait their hair like other Chinese, may conclude marriages.

A priest who obtains a woman under the pretence that she shall marry another, and who then marries her himself, is severely punished.

Marriage is impossible between slaves and free women.[21] *Note.*—It is not considered decent in China for a widow to marry again.[22] Should the head of the family try to force her into marriage, she is not obliged to obey his *patria potestas*, but may remain with the family of her late husband. Should however the marriage be concluded, she shall live with her new husband, the marriage presents, or rather the purchase money paid for her being forfeited to the Government.

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20 There are in China 5 classes of nobility (爵 *chüeh*) : 公 *kung*, duke, 侯 *hou*, prince, 伯 *po*, count, 子 *tzu*, baron, 男 *nan* baronet. When the nobility conferred is not "perpetually hereditary" each descendant takes one rank lower than his father; so that the son of a *kung* becomes *hou*, the son of a *hou* becomes *po*, and so forth, nobility ceasing altogether with the son of a *tzu*. 侯 *hou* (I may be permitted to remark here) has generally been translated by marquis. But this title is of limited use and does not express the rank of a *hou* as well as prince; as in former times the 諸 侯 *chu-hou* were feudal princes and not feudal marquises.

21 See Mayer l. c. II p. 301. According to the laws of the Longobards parents had the right to kill or sell their daughters, if they married one in socage. Leg. Long. lib. II tit. 9, § 2; L. Rothari c. 222.

22 Puchta, Instit. des röm. Rechts. III p. 177: it was decent according to the Roman national feeling, that a widow should remain single, univira meant the same as castissima. She was highly esteemed and received the wreath of chastity. Val. Max. II c. 1 Propert. IV eleg. 12. The Israelites however were much in favour of a second marriage of widows, see Mayer l. c. II p. 322.

c.—Effects of the Impediments to Marriage.

Any impediment to marriage renders the marriage, as, in the time of Justinian,[23] though already concluded, null and void; the *impedimenta* are always *dirimentia*. Ignorance of them exempts the parties from punishment, but the marriage is dissolved. According to the sense of the marriage contract the parties who signed it are punished, if the marriage laws are transgressed; but the husband and wife, are not punished unless they are *sui juris*. If the father, grandfather or uncle signed the contract, they alone are punished; if it was another relative, he is punished as principal, and the husband and wife as accomplices. The purchase money is in each case forfeited, except when the parties were ignorant of the existence of the impediment.

A dispensation in cases of impediments to marriage is not admissible.[24]

Difference of religion has in China no influence upon marriage.

III.—Betrothal.

a.—The Contract.

The conclusion of a *justum matrimonium* has to be preceded by a contract,[25] in which the amount of presents (*arrhae sponsalitiae*) and the latest day for concluding the marriage is fixed. This contract is made, and if in writing, is signed by those persons, in whose *patria potestas* the bride and bridegroom stand; the latter never sign it, unless both have no older relatives; this latter condition, and the fact of the son holding office, being the only cases, in which a *filius* or a *filia familias* becomes *sui juris*. This is the chief distinction between the Chinese and the Roman marriage.

In Chinese marriage there cannot exist the *animus matrimonii*, the intention of husband and wife to form a connection for life, which is the chief requirement in the Roman marriage. According to Roman law the assent of the *pater familias* was required, but could only be refused for special reasons; husband and wife, however, were allowed free choice.

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23 § 12 J. de nupt. (1, 10). Cod. 5, 8.

24 The Israelites also did not know of such dispensations, see Mayer l.c. II, p. 315.

25 Known by the Romans, Dig. 23, 1.—Cod. 5, 1; and by the German law, Eichhorn, Rechtsgeschichte § 54, § 183, § 321.

Among the Chinese the heads of the families choose alone, and the inclination of the principal parties is not asked.

Before the signature of the marriage contract by the heads of the two families, both parties convince themselves of the truth of the statements regarding the persons of the bride and bridegroom, that they are sound in body and mind, and that they are not too old. The festivities of the betrothal then commence. As lies in the nature of the case, the age of the betrothed parties is of no consequence.[26] If often happens, that a betrothal is made between friendly families at a time, when the bride and bridegroom are not over three or four years of age.

b.—Effects of Betrothal

The contact of betrothal gives both parties a right to sue for the conclusion of marriage.[27] The party who refuses to keep the contract is punished with fifty blows, and the court enforces the marriage. Inacase in which the contract was not made in writing, the acceptance of presents is taken as an agreement to the contract.

The betrothal may even be maintained, if the family of the bride enters a second betrothal[28]; and only in case that the family of the bridegroom waives its claim, may the bride marry the second bridegroom. The presents are, in the latter case, to be returned.

A forcible abduction of the bride before the time fixed for the marriage, is punishable; as is also a delay on the part of the family of the bride beyond the term fixed for concluding the marriage.[29]

A singular situation arises, if a *filius familias* enter a betrothal during his absence from his family, his grandfather, father, uncle or older cousin, *i.e.* a person in whose *patria*

26 Not so in Roman law, l. 14 D. de spons. (23, 1): in sponsalibus contrahendis aetas contrahentium definita non est, ut in matrimoniis—si non sint minores quam septem annos.

27 The same according to canonical law, but in contradistinction to Roman law l. 2 § 2 D. de div. et repud. (24, 2): in sponsalibus discutiendis placuit renuntiationem intervenire oportere—const. 2 C. de spons. (5, 1)—l. 134 D. de verb. oblig. (45, 1)—const. 2 C. de inutil. stipul. (8, 39); actio ex stipulatu.

28 The Roman law punished this with infamy, l. 1, l. 13, pr. § 1-4 D. de his qui not. inf. (3, 2); const. 18. C. ad leg. Jul. de adult. (9, 9).

29 According to Roman law an action could be entered for delay of marriage without reason over 2-3 years, const. 16 C. de episc. and (1, 4)—const. 2, 5. C. de sponsal. (5, 1) const. 2 C. de repud. (5, 17).

potestas he stands, having, in the meantime, chosen a bride for him, and having signed the contract. If the son have concluded marriage, the betrothal made by the head of the family is dissolved. Otherwise the contract made by his family takes precedence over the other made by him.

c.—Dissolution of Betrothal.

If after signing the contract it appears that false statements have been made by the family of the bride, then the contract is void, the presents are returned and the *pater familias* of the the bride receives eighty blows. The punishment for a like fraud on the part of the bridegroom's family is more severe, and the bride keeps the presents. Should the fraud be discovered after marriage has been concluded, an action for divorce can be entered.

If the betrothal be dissolved before the conclusion of marriage, either through the death of bride or bridegroom, or through withdrawal of both parties (*repudium voluntarium*), or through an impediment to marriage just arisen, or only just come into notice, then the presents have to be returned. If the marriage be not concluded through the *repudium* of one party, the party innocent of the dissolution of the betrothal gets back or eventually keeps the presents.

The fact of bride or bridegroom having been punished for thefts or fornication gives a right to cancel the contract.

IV.—Conclusion of marriage.

In China the church has nothing to do with the conclusion of marriage; neither are the usual ceremonies and festivities absolutely necessary for the conclusion of a *justum matrimonium*, as long as the *consensus matrimonialis* exists between those persons who sign the marriage contract.

At the time of the conclusion of the marriage the bridegroom gives to the father[30] of the bride the so-called marriage presents, which sometimes amount to thousands of taels. The conclusion of the marriage is therefore preceded by a purchase, which is no mere sham transaction like the Roman coemtio, but corresponds to the purchase of the ancient German laws and to that of the Jewish law.[31] By accepting the purchase money, the father of the bride sells and manumits his daughter to the bridegroom.

30 The talmud says : the matrimonial purchase money belongs to the father. See Mayer l.c. II., p. 326.
31 See Mayer l.c. II., 353.

When the marriage is celebrated; the wife leaves her family for ever (出 家 *ch'u chia*) and belongs from this time to the family of her husband,[32] i.e. she considers the parents of her husband as her own, and mourns for them legally a longer time than for her own parents.

Whilst the purchase of a wife is called marriage (娶 妻 *ch'ü-ch'i*) the expression for the purchase of a concubine (立 or 買 妾 *li* or *mai ch'ieh*) points to the inferiority of the action. The union is concluded without festivities.[33] The punishments for transgressions against the marriage laws in the case of concubines are less severe than in the case of a wife.

V.—Relation of Husband and Wife to Each Other.

Through the marriage the wife becomes, as was the case according to the law before Justinian[34] not only *uxor*, but also comes into the *manus mariti.* "She therefore ceases to be *sui juris,* if she was it, and leaves the *patria potestas,* if she stood under it. At the same time she enters the agnatic union of her husband like an adopted daughter; and especially comes into the position of an agnatic sister to his agnatic children."[35]

It is in consequence of the way in which the wife comes into the power of her husband that she acquires very few rights with the marriage. Though she shares the rank and the position of her husband (as the Roman wives shared the *dignitas mariti*), she has no right to ask conjugal fidelity from her husband;[36] whilst she, by sinning against it, commits a heinous crime.[37]

It is a cause for divorce, if the wife beats her husband, but the husband has the right to inflict corporal punishment on her. He is however punishable, if by doing this he inflicts a wound; but he comes off with a mulct, if he and his wife are willing to divorce.

32 According to the Jewish law, the family of the mother is not called family. See Mayer l c. II., p. 283.

33 The same with the Israelites: wives with nuptials and with marriage bond, concubines (pillegesh) without either; the same holds good for the Greek *pallax*; it is different, however, with the Roman *pellex*, l. 144 D. de verb. signif. (50, 16.)—Nov. 18 c. 5

34 Mackeldey, Lehrbuch des röm. Rechts, 14th edition, vol. II., p. 266; comp. Gaj. Inst. § 49, § 108 ss., II § 86 ss.

35 Mackeldey, l.c. II., p. 274, note; Gaj. Inst. III. § 14, 24. Coll. XVI., § 6.

36 Unlike the Romans, Nov. 117 c. 9 § 5: liceat mulieri propter hanc etiam causam matrimonium dissolvere.

37 See Mackeldey l.c. II., p. 274.

The wife owes the husband implicit obedience, and is not allowed to leave the house without his permission. If she act against this, her husband may sell her to another as concubine. Even after the death of her husband she remains in his family.[38]

The wife cannot possess property of her own, "everything she possessed before entering into the *manus* passes into the hands of her husband,"[39] so that even property inherited by her remains with the husband after the marriage has been dissolved.[40]

The questions therefore of *dos*, *parapherna*, *pacta dotalitia* and *donatio inter virum et uxorem* exist in Chinese law just as little as in the ancient Roman law.

As the power of the husband is transferred after his death to his wife, the Roman *donatio propter nuptias*, and the Jewish Ketubah (marriage bond) are excluded from Chinese law.

With all his power the husband is not allowed to hire out his wife to prostitution,[41] although it sometimes happens that a man whose wife has not born a son and does not allow him to purchase a concubine, hires for a time the wife of another to get a son by her.

VI.—Dissolution of Marriage.

Besides death and *maxima capitis diminutio* of husband or wife, divorce may be the cause of dissolution of marriage.

a.—A divorce *must* take place, if there exists an impediment to marriage or if the wife commits adultery. The husband has in this case the right to kill both adulterers, if he surprises them *in flagranti*.[42] If he does not kill the wife, she is punished according to law and then sold as a concubine, the purchase money for her being taken by the government. If the adulterer kills the husband, the wife is strangled.[43]

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38 Similar the Roman law, l. 22 § 1 D. ad municip. et de incol. (50, 1): vidua mulier amissi mariti domicilium retinet.

39 See Mackeldey l.c. II., p. 275; Gaj. Inst. II. § 86 ss. III. § 82 ss. Ulp. XIX, § 18.

40 Gaj. Inst. II. § 98: si quam in manum ut uxorem reciperimus, ejus res ad nos transeunt.

41 In Rome lenocinium facere was punished with infamy, l. 1, l. 4 § 2, 3 D. de his qui not. inf. (3, 2)—l. 43 §6-9 D. de ritu nupt. (23, 2).

42 Compare Leviticus 20, 10.

43 L. 43 § 12, 13 D. de ritu nupt. (23, 2).

b.—A divorce *may* take place

1.—If both husband and wife are willing to dissolve the marriage;
2.—If the wife leaves the house against the will of the husband. Should she marry whilst absent, she is to be strangled;
3.—If the wife beats her husband;
4.—If the marriage contract contained false statements;
5.—If the wife has one of the following seven faults: barrenness, sensuality, want of filial piety towards the husband's parents, loquacity, thievishness, jealousy and distrust, incurable disease.

The husband is, however, obliged to keep her in spite of one or several of the above faults; if she has kept the full term of mourning for three years after the death of his parents, or if his family, having been poor at the time of the conclusion of marriage, has since become wealthy, and, lastly, if the wife has no other relatives to whom she may return after divorce.

The effects of the dissolution of the marriage are the following: the marriage is considered as having never been concluded; the wife returns to her family, the children remain with the father and the purchase money is given back to the husband, except in the case that the latter was the cause of the divorce.

Nothing is to be found in the Chinese laws regarding any offence on the part of the husband which gives to the wife the right to enter an action for divorce.

VII.—Polygamy.

As mentioned above the wife who maliciously leaves her husband and marries another in the lifetime of her husband, is strangled.

If in the lifetime of his first wife (妻 *ch'i*) the husband marries another (妻 *ch'i*, not a concubine 妾 *ch'ieh*, as he is allowed to have as many concubines as he likes), the marriage is void; the wife returns to her family and her father keeps the purchase money, unless he knew of the existence of the first wife. In this case the money has to be paid to the government.

VIII.—Second Nuptials and Violation of the Time of Mourning.

Remarriage of the husband is permitted even without delay after the death of the first wife. The widow, however,

against whose remarrying custom generally is opposed, has to mourn three years for her husband.

If the husband has abandoned his wife, she has at the end of three years to give notice to the competent magistrate, who may then give her the permission to marry again.

B.—ON PATRIA POTESTAS.

I.—GENERAL REMARKS.

As was the rule according to the Roman law of the time before Justinian, all persons, who depend on a *pater familias*, either grandfather, father, uncle, mother or husband, stand in China under *patria potestas*; such persons are therefore either the wives of the *pater familias* or his sons and daughters or more distant descendants on the male line. The *patria potestas* is the same as the *domini potestas*, the power of the master over his slaves, according to the ancient Roman law.

If a man has got a girl with child, he must marry her; in the case of his already having a wife, he must take her as a concubine. But in any case, even if he is prevented by death from marrying her, the child is considered his legitimate offspring.

Illegitimate children, who are not made legitimate *per subsequens matrimonium* (私子 *ssŭ-tzŭ*) and children of prostitutes (雜種子 tsa-chung-tzŭ, *vulgo quaesiti*) stand under the power of the mother, whose family name they bear.

II.—ON THE RIGHTS OF BOTH PARENTS WITH REGARD TO THEIR CHILDREN.

The *patria potestas* over children, whether legitimate or adopted, is unlimited. The father, or after death the mother,[44] can do with them as he likes; he may not only chastise, but even sell, expose or kill them.[45] The latter occurs often enough, especially with girls, if the family is too poor to bring them up. Infanticide is not prohibited, but whenever it spreads too far, the officials issue proclamations against it. Moreover it is generally considered as blamable and the voice of the people

44 Therefore not like Gaj. Inst. I. § 104.—§ 10 J. de adopt. (1, 11): feminæ—nec naturales liberos in sua potestate habent; but the same as the law of the Visigoths, Mayer l c. II. p. 416.

45 The same power was given the father by the Romans (§ 2 J. 1, 9; Gaj. Ins. I. § 55,) by the Gauls (Cæsar de Bell. Gall. VI., 19) and by the Visigoths (Mayer l.c. II. p. 416, Lex Wisig. IV., 2 § 13).

is raised against persons, who carry the abuse of the father's power thus far.

The power of the father over his son does not cease as long as the father lives, unless the son enters the government service.[46] The father, wanting to exercise his rights over him, has to obtain first the assent of the Emperor.[47] Over the daughter the power of the father exists until she comes into the *manus* of a husband.[48] If the marriage is divorced, the daughter returns into the power of her father; as widow, however, she remains in the family of her husband.

III.—On the Rights of the Husband with regard to his Wife.

The wife follows her husband, wherever he likes to go and may not leave the house without his permission. The husband has the right to chastise his wife, but not to wound her (see above, the causes for a divorce).[49] He has not the right to kill her, except in the already mentioned case, that he surprises her *in flagranti delicto.*

IV.—On the duties of the Children towards their Parents.

As long as the parents live it is the duty of the children to show them reverence and obedience (孝順 *hsiao-shun*) and if necessary to nurse and support them.[50] The son shall, if father, mother or grand parents, are over eighty years old or feeble and ill, remain at home, unless another son over sixteen years old lives with them. This command is specially in force for officials. As long as parents, grandparents, or husband are in prison on account of a capital crime, the children, grandchildren and wife are not allowed to participate in festivities and amusements of any kind. Disobedience towards parents and grand-

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46 *In publicis locis atque muneribus atque actionibus patrum jura cum filiorum qui in magistratu sunt potestatibus collata interquiescere paululum et connivere, etc.*, Aulus Gellius, Noctes II, 2, see Gibbon, Rome, chapt. XLIV. (ed. 1815 vol. VIII p. 54.)

47 The same according to the ancient German law, Mayer l.c. II. p. 443.

48 The same we find in the Israelitic law, Mayer l.c. II. p. 440.

49 According to the Mosaic law the husband was not allowed to cruelly illuse his wife, Mayer l.c. II. p. 382.

50 According to the Talmud (Kidushin 31a., Jorch deah 240 § 1 and 4) the children are obliged to honor, next to God, their father and mother the most, and to nurse and support them.

parents and deficient support of them is on the motion of the concerned severely punished.[51] Descendants are not allowed to enter an action against ascendants; they are not obliged to denounce crimes committed by them or to appear as witness against them. This exemption extends to all members of the same household, even to servants and slaves.

After the death of the parents it is the chief duty of the children to strictly keep the term fixed for mourning and to rigorously perform the sacrificial ceremonies on their graves. The coffin has to be buried, if at all feasible, in the native soil.[52]

V.—Acquisition of Patria Potestas.

Patria Potestas may be acquired (*a*) through marriage, (*b*) through procreation, (*c*) through adoption, or (*d*) through purchase. If the person who acquires *patria potestas* in one of these four ways, stand himself under *patria potestas*, then he acquires it for his *pater familias*.

a.—By Marriage.—The wife belongs after marriage to the family of her husband, and stands in his, or in the *manus* of that person, under whose *patria potestas* the husband stands.

b.—By Procreation.—Children come under the *patria potestas* of their father, whether born by a wife or by a concubine.

c.—By Adoption.—To explain this institution, most important in Chinese law, we take the Roman law as a type.

A man may adopt a person as son or daughter; or if he formerly had sons, as grandchild, but not as brother, wife or concubine.[53] Ninety-nine per cent of all adoptions in China take place in childless families, and among these seventy per cent are adoptions of sons. Fifty per cent of all families in China possess adopted children (E. H. Parker).[54] The

51 According to Deuteronomy 21, 15; Leviticus 20, 9 and V. Moses 27, 16 even disesteem of the parents is to be punished by death.

52 How difficult this duty may sometimes be, was shown by the case of the late Taotai Fung, who went as far as Kansu in the North-west of China to fetch the coffin of his father and to bring it overland to Canton, his native province. The difficulties of this voyage, on which many ceremonies had to be performed, exhausted the son to such an extent that he succumbed when only half the voyage was completed. His brother took his place and continued, after the short delay prescribed by law, the voyage to Canton with the two coffins.

53 L. 37 pr. D. de adopt. (1, 7).

54 Compare the law of Menu IX., 127, 159; the Hindu considers it his religious duty, to have a son, by whose means he may pay off his debt to his forefathers. If he remains childless, he must adopt one.

same that is said with regard to the adoption of the ancient Greeks, holds good for the Chinese: "the dying out of a family was to be prevented, as by the desolation of the house the dead lost their religious honour, the gods of the family their sacrifices, the hearth its flame and the forefathers their name among the living."

Adoption, like marriage and the acquisition of slaves, rests in China upon purchase, about which a contract is made, in which only the words wife, son, daughter or slave are differently inserted. The most frequent case is the adoption of nephews by the childless uncle. But besides this direct adoption there is another way to procure descendants to such uncle. The nephew marries a concubine, and the children born by her are regarded as grandchildren of the uncle; whilst the children of the nephew's wife are the grandchildren of the nephew's father. The Chinese call this method 雙祧 *shuang-t'iao.*

It being prohibited in China for officials to hold office in their native province, adoption becomes the means of avoiding this restriction. The official in question is adopted into a family of another province, acquires a right of domicile in the province of his adopted parents, and may now hold an office in his original native province. In the same way confiscation of property is prevented by adoption, if such confiscation of property is imminent on account of the crimes of near relatives.

1—*General Requirements of Adoption.*

As the main idea of Chinese adoption may be stated, that only children may be adopted out of families, who bear the same family name; as otherwise, as the Chinese express it, the difference between families would soon cease to exist.

No special requirements are prescribed for the adopter, and the law fixes no age under which one may not adopt,[55] although it is usual, that the adopter is older than the person to be adopted. Foundlings under three years old may be adopted without further ceremony.

55 As is the case in Roman law, § 4 J. de adopt. (1,11): minorem natu non posse majorem adoptare placet; adoptionem enim naturam imitatur et pro monstro est, ut maior sit filius quam pater. Debet itaque is qui sibi per adoptionem vel arrogationem filium facit, plena pubertate, id est XVIII annis praecedere. L. 40 § 1 D. de adopt. (1, 7).

It is permitted to emancipate the adopted, and to adopt him a second time.[56]

The wife, acquiring after the death of her husband his *patria potestas*, has therefore the right of adopting;[57] she has, however, to ask the consent of the nearest male relatives of her late husband, for adoption as well as for *datio in adoptionem*. She has further the right of preventing the legitimate or adopted sons of her husband, from giving themselves into arrogation against her wish.

It is not allowed to adopt one's younger brother or one's uncle, even if the latter is younger than the nephew; for the same reason the uncle may not adopt a nephew, who is older or of the same age as he is.

2.—*Special Requirements.* *aa.—Of Arrogation.*

Whoever wants to give himself into arrogation, must ask for the consent of the nearest male relatives of his former *pater familias*. If he has elder brothers alive, their consent must be asked. In the lifetime of his father the son may give himself, even without the consent of his father or his relatives, into arrogation, if the father is insane and poor, so that the son by the arrogation acquires the means to support him. If the father is far away, the son is allowed to be arrogated, but the father may, on his return, claim back his son.

bb.—Of the datio in Adoptionem.

According to its nature the *datio in adoptionem* is properly speaking a sale (*venditio*), to which only the consent of the *pater familias* is required; the person to be adopted is not asked except he be a son holding office. In practice however it never happens, that an adult married son is sold into adoption against his own free will. The wife of the adopted follows her

56 Not so in Roman law, l. 37 §1 D. de adopt. (1, 7): eum quem quis adoptavit emancipatum vel in adoptionem datum iterum non potest adoptare.

57 The Roman wife had not this right, §10, J. de adopt. (1, 11): feminæ quoque adoptare non possunt. Const. 5, C. de adopt. (8, 48); mulierem quidem quæ nec suos filios habet in potestate, arrogare non posse certum est. In Egypt this right was conceded to the wife, see Mayer l. c. II p. 427.

husband, but the children remain in the family of the *pater familias.*[58]

A man having sons of his own may not adopt a stranger as their elder brother, but he may adopt grandchildren as sons of his legitimate or adopted sons. After his death the latter have the right to dissolve such adoptions.

Brothers may, after the death of their parents, give their elder or younger sisters into adoption, but not without their consent.

Even after death a *filius posthumus* may be adopted for a person by his relatives or friends, in case that this person died without leaving male descendants. By special grace the Emperor may do this for princes or high dignitaries, but in all cases with the consent of the male relatives of the deceased.[59]

3.—*Effects of Arrogation and of Adoption.*

The effects are in either case the same.[60] The adopted becomes agnate of all agnates of the arrogator or of the adopter. The adopted son has altogether a better position than the natural one, as he cannot be sold without the consent of his natural parents, unless a second adoption be of real benefit to the child. He has all the rights of a son or a daughter. In the case of inheritance, natural as well as adopted sons take precedence before all daughters.[61] Should the adopter get sons born after the adoption so that the original cause for the adoption no longer exists, he may retrograde the adoption, if the parents are willing to take back the child. The child must be kept, however, if no member of his family lives, to whom he can return; only officials may thus be left without family.

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58 According to Roman law the children of an arrogated person followed their father, the children of an adopted person remained with their grandfather, l. 2 §2 D. de adopt. (1, 7): is qui liberos in potestate habet, si se arrogandum dederit, non solum ipse potestati arrogatoris subjicitur, sed et liberi ejus in ejusdem fiunt potestate tamquam nepotes. l. 40 pr. D. de adopt. (1, 7): quod non similariter in adoptione contingit, nam nepotes ex eo in avi naturalis retinentur potestate.—l. 26, 27 D. ibid: ex adoptivo natus adoptivi locum obtinet in jure civili.

59 This adoption after death was also known to the Greeks, Demosth. c. Makartat 1053, 12; Isæus e.d. Hagnias 298, Is. e. d. Apollod. 179 (Mayer l. c. II, p. 429).

60 Not so in Roman Law, l. 1 l. 23 D. de adopt. (1, 7).—§2 J. de adopt. (1, 11).—const. 10 pr. §5 C. de adopt. (8, 48).—pr. J. de adopt. (1, 11).—§13 J. de hered. (3, 1).

The adopted child being regarded as the real child of his adopted parents, these must give their consent, if the child wants to commence a three years' mourning after the death of his natural parents. An official is not allowed to mourn twice three years, but only for his adopted father, as mourning means in this case withdrawing for the time from the official life.

VI.—Termination of Patria Potestas.

With the death of the father, his power passes over to the mother, and after her death to the eldest son, who then has also power over his younger brothers and his elder and younger sisters.

a.—Without the will of the Father.

The father's power does not cease to exist in the lifetime of the father unless the son holds office. Except with the special permission of the emperor the father in this case cannot exercise his power over his son. As mentioned above, the son becomes *quasi sui juris*, if the father is insane and at the same time poor.

b.—With the will of the Father.

(Excepting the case of the father giving himself into arrogation, so that his children come under the power of his arrogator) the father's power may cease with the will of the father:—

1.—By sale into adoption, by which the son acquires agnate rights in the family of his adopted father;

2.—By sale of a daughter into marriage, she becoming an agnate in her husband's family and coming into his *manus*;

3.—By the permission to enter a religious order. The children then lose their family name and leave the family connection altogether (出家 *ch'u chia*);

4.—By exposing the children in the tender age. The finder may lawfully adopt them, if they are under three years of age.[62] If they are older than three years, it is prohibited to expose them; and only the ways mentioned under No. 1 and No. 3 are left to the father to rid himself of his child.

In contradiction to the Roman law[63] the father may dissolve his power even against the wish of his children.

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61 See Alabaster, the law of inheritance, China Review vol. V p 191-195.

62 Const. 2, 4 C. de infant expos. (8, 52). Nov. 153 c. 1 (non gloss.)

63 Nov. 89 c. 11 pr.: solvere jus patriae potestatis invitis filiis non permissum est patribus.

An emancipation in the Roman sense, by which the emancipated person becomes *sui juris*, does not exist in China. After the death of the father, the daughter becomes *sui juris*, if she is widow and has children, the son only in case he has a family.

C.—ON GUARDIANSHIP.

If at the time of the parents' death the children are still very young (under 7 years), and no head of the family exists who has *eo ipso* a right to the *patria potestas*, the fathers' power devolves upon one of the male relatives of the same name (同姓親戚 *t'ung hsing ch'in ch'i*), if no *testamentaria tutela* has been ordered. If no such relative exist, then one among the male relatives of a different family name (外姓親戚 *wai hsing ch'in ch'i*) is chosen. To be without any such relationship, is in China an impossibility. If after the father's death the mother is unwilling to take the responsibility of the *patria potestas* upon her, such guardian has to be appointed.

The guardian has the full *patria potestas* and keeps it, like the father, as long as he lives (with the above mentioned exceptions). The property of the child, of which the guardian has the full usufruct, continues to be the child's.

ARTICLE IV.

THE STORY OF THE EMPEROR SHUN.

By Thos. W. Kingsmill.

FOLLOWING the example of the Canon of Yaou that of Shun begins in a very similar manner—"According to tradition the ancient emperor (帝 Tî) Shun was called Ch'ûng-hwa." This name is equally inexplicable with the title similarly bestowed upon Yaou, if we simply look at the Chinese characters made use of. Taking them, however, as simple phonetics, and following the usual rules of phonetic change,[1] we find that it is in correspondence with Sanscrit Sûrya—the Sun in its glory.

Shun's own name tells us a similar story. He was introduced to Yaou (Varu*n*a) as an unmarried man of the lower people called in, modern Chinese, Yu-shun; but the phonetic element in the former character 虞 points to *Wu* or *Vu* as the original pronunciation; and for the latter we find the sound *shun*, in 惇, *pure*, to *wash*, for instance, Sanscrit *snâ*; and 順, to *accord*, *complaisant*, Sanscrit *snu* to *flow*, etc., representing the inverted combination *sn*. Wŭsnu or Vu-shnu we may, therefore, conclude was the most ancient pronunciation of the name, in other words Vish*n*u—the Lord of the Sun,—the wide-stepping, whose three paces comprehended in their fulness the earth, the atmosphere and the sky, in the successive forms of Agni, Vâyu and Sûrya.

How this corresponds with the mythical elements of the story I shall show further on.

The Chinese legends give us small information as to Wushun's antecedents. He was the son of Kûsow, literally, the blind old man, but whether to look upon this word as an

1 Cfr. sur, to shine, in Chinese 昌 *c'hang*, to illuminate, refulgent; 爽 *shwang*, light, sunny, pleasing. Hwa is simply phonetic representing *ya*.

appellative or a simple phonetic, neither the text or analogy seems to point out.[2] According to Mencius,—a good authority on the ancient myths of China, Wu-shun was born at Chû-fang (? Turvar), removed to Fu-hia (Harivartha), and died at Ming-t'iaou, (Mandara of the Indian legends) the site also of T'ang ch'eng's battle in the Shang story. He was said to have been a man of the eastern tribes (I), as was Man-wang of the western.

The name Wu-shun has, of course, by the Chinese, been divided, and he is generally known as Shun of Yu or Wu ; but apart from the violence done to the legend, which calls him distinctly one of the common people, there is no need to have recourse to this interpretation. The older commentators, including the preface to the Shoo-king, apparently speak of him simply as Wu-shun. Occasionally, as in the Shû-king, V., xx. 3, he is called simply Wu, so that it was a matter of accident which portion of the name would eventually become his personal appellation.

We may, therefore, content ourselves with receiving him as of concealed or unknown ancestry, and thereby save ourselves the necessity of enquiring, according to the fancy of the native commentators, by how many degrees of relationship he was removed from his predecessor Yaou. In this respect he resembles his analogue Vish*n*u in the Rigveda, who is as yet scarcely more than an abstraction, not having clothed himself with the personality of deity attributed to him in the Purâ*n*as. It was later in the Brâhmanas that Vishnu came to be classed with the Adityas or sons of Aditi, as great an abstraction apparently as Kúsow.

Like so many other manifestations as the solar deities, Wu-shun was not allowed to come into the world without molestation. His parents, we are told, hated him. Like Herakles he was to be set aside in favour of his half brother Siang (the Duplicate), and their main anxiety is to get rid of him. He is,

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2 The Shi ki invents a genealogy for Shun. His father was Kû sow 瞽叟, Kû sow's father was 橋牛 K'iu ngo, K'iu ngo's 句望 Ko mong, Ko mong's 敬康 King k'ang, King k'ang's 窮蟬 K'ung shan, K'ung shan's the emperor 帝 Chwan huk 顓頊 from whose father 昌意 Ch'ang i to Shun were thus seven generations. The genealogy is of the same value as that of the Hiung nû from Yü or the kings of Wû from T'ai Wang—zero.

therefore, ordered to plaster a granary, to which fire is set. Escaping from the fire, he is directed to dig a well, when at the bottom they attempt to fill it up. From these dangers he is, as becomes his character, miraculously preserved. His brother designs to possess himself of Wu-shun's peculiar attributes. "Let my parents," he says, "have his oxen and sheep; let them have his stone houses and granaries. His shield and his spear shall be mine; his lute shall be mine; his bow shall be mine; his two wives I shall make attend me to my bed. Siang then went into Shun's hall, and there was Shun on his couch playing on his lute."[3]

Wu-shun is set to plough in the channelled fields by the Lik shan, the word Lik itself denoting the path of the heavenly bodies.[4] His parents oppress him, and he cries in agony to High Heaven. His filial piety attracts notice. The emperor (Ti as before) Yaou sends his nine sons and his two daughters to wait on him, and multitudes of the scholars of the empire flock to him. He plays the potter (陶 t'ao) at the Thunder (Lui) Lake, or rather performs service (徭 yao) as the text apparently indicates. "His four limbs had not even a temporary rest, for his mouth and his belly he could not find pleasant food and warm clothing—sorrowfully came he to his death. Of all mortals never was one whose life was so worn out and embittered as his."

Such was the life of the hero whose fame now fills the pages of Chinese tradition.

He was, according to the orthodox tradition, called upon by Yaou when the latter was failing in power and influence to assist him in ruling the empire; but we find that he has little connection with the inundating waters, the management of which is still left to K'wan or Yu.

Other traditions differ from that generally accepted as to the relations between him and his predecessor. According to versions still current in the latter periods of the Djow dynasty he was rather the superseder than the simple coadjutor and helper, as finally the descendants of Herakles supersede the successors of Eurystheus on the throne of Mykenai. Ouranos, as representing the older gods has to give place to Kronos, so Yaou, his correlative has to yield the sceptre to Wushun. The Tso-

3 Mencius V. I. II. 3.; Dr. Legge's translation.

4 Cfr. Sanscrit laksh, *videre*, *observare*; lakshana, *nota*, *signum*.

chuen more than hints at the contrast between the two. The ancient emperors Kaou-yang and Kaou-sin had each eight worthy descendants who offered their services to Yaou; who was not able, adds apologetically the chuen, to raise them to office. No sooner did Wushun become Yaou's minister than he placed them in high positions, to reduce the earth to order, and to aid the influences of Heaven; to promote the proper duties of relationship, "so that in the empire was order, and beyond submission."[5] Four villains also lived in his time, apparently corresponding to those mentioned in the Shû, Hwantan, K'ung k'i, To ngat and T'o t'it, villains, slanderers, obstinate and greedy. Yaou could not find it in his heart to put them away, but when Wushun became minister and received the nobles from the four quarters, he banished these four wicked ones, thrusting them out into the four distant regions to resist the (goblin) Lîmî.

The Chinese euhemerists go beyond this. Some of them make Wushun dethrone Yaou and keep him a prisoner; raise Tanchû for a time to the throne, and then depose him, and thereafter allow no intercourse between father and son.

Turning to the Shûking we find in rough archaic metre, mixed with more modern prose, the orthodox account of Wushun's doings.

"Setting forth the excellencies of the five Canons
"The five Canons came to be observed
"Entering on the hundred rules[6]
"The hundred rules were punctually administered.
"Receiving his guests at the four portals.
"The four portals shone majestically.
"Entering on the great Loka[7]
"The impetuous winds, thunder and rain did not bewilder him.

"To him appertained the Siuenki (Chakra or Discus) and the jewelled Wang (Çangkha or Conch)
"By means of which he regulated the Seven Directors.
"He sacrificed to the gods above[8]
"He offered to the six Honoured Ones
"He sacrificed to the hills and streams
"He visited the host of spirits.

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5 Ch'un t'siu VI. year 18.

6 揆 Kwei is the equivalent of Gr. *καιρὸς*, *occasio*, *opportunitas temporis.*

7 The great Loka (大麓 *ta lok*) seems the equivalent of the Lokaloka of the Vishnu Purâna surrounding the golden mountain Meru.

8 上帝 Shang ti *i.e. dei superi*, 帝, used later for emperor, in old

"In the second month eastward he performed his circuit
"As far as Tai tsung
"He offered burnt sacrifices to the hills and streams
"He did homage to the Regent of the East
"He harmonised the seasons and months, and regulated the day.
"He put in accord and fixed the meridians and parallels
"He regulated the five ceremonies."

Similarly at the other seasons he proceeded to the three other cardinal points represented by the remaining three Yoks, finally arriving at Ngai tsu he sacrificed? (用 yung) a bullock. "He laid the foundations of the twelve islands, piled up the twelve mountains, dug out the rivers."

He arranged the code of punishments "What reverence," adds the author, "that compassion should temper punishment." He banished Kung kung to the Dark Island (Yao or Yew-chow); drove Hwantow to Tsung-shan; hid Sam-miaou (Çambara) at Samwei; killed Kwan (*κρόνος*) at Mount Yu. The number of the villains here agrees with that in the Tso chuen, and some resemblance is evidently indicated in their names; Hwantan (*cfr.* Sans. Vandi *captivus*) is in the Tso-chuen made a descendant of Hwangti, K'ungk'i (cfr. Sans. garh *maledicere*) of Shaou haou; T'o ngat of Chuen heuh; and T'o t'it of the officer Tsin yun. So in Indian legend Indra attended by his faithful comrade Vish*n*u "hurries off to encounter the hostile powers in the atmosphere who malevolently shut up the watery treasures in the clouds. These demons of drought called by a variety of names as V*r*ittra, Ahi, Çush*n*a, Namuchi, Pipru, Çambara, Ura*n*a, &c., &c., armed on their side also with every variety of celestial artillery, attempt, but in vain, to resist the onset of the gods."[9]

But Çambara has a personal history connecting legend with myth. Rigveda VII, 99, &c. describing the powers of Vish*n*u connects him with the overthrow of Çambara, as does the Chinese legend Wushun with that of Sam-miaou, in a manner throwing much light in the Chinese myth. "No one, O divine Vish*n*u, who is being born, or who has been born, knows the furthest limit of thy greatness. Thou didst prop up the lofty and vast sky; thou didst uphold the eastern pinnacle

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Chinese had the value of deus, Sans. deva, with which it is etymologically connected. There is no trace in the Chinese classics of the form 上帝 being used in the sense of *Deus Supremus*.

9 Muir's Original Sanscrit Texts, Vol. V. 94.

of the earth. Vishnu, thou didst prop asunder these two worlds; thou didst envelope the earth on every side with beams of light. Ye (Indra and Vishnu) have provided ample room for the sacrifice, producing the sun, the dawn and fire. Ye, O heroes, destroyed in the battles the wonderful powers of the hostile Vrishaçipra. Indra and Vishnu ye smote the ninety-nine strong cities of Çambara; together ye slew, unopposed, a thousand and a hundred heroes of the Asura Varchin."[10]

Çambara besides his mythical existence had moreover a legendary one, accounting for the second portion of his traditional name in Chinese. The Chinese commentators acknowledging the individuality of the object of the legend make him the prince of the Three Miaou, missing the phonetic form of the word as disguised by the Chinese characters. In the Indian legend, then, Çambara assumed flesh and blood as an ancient aboriginal king, a dark-skinned enemy, who dwelt forty years on the mountains and possessed a hundred impregnable cities. These cities were desired by Divodasa who attacked them in vain; Indra came to his help and with Vishnu smote the cities and killed their ruler. In both legends exists the remembrance of a prehistoric combat with aboriginal tribes. Çambara lived in Udavraja, a country "into which the water flows" as Samwei, the latter syllable apparently corresponding to *Vraja* of the other, is mentioned in connection with the Yokshui, the Weak, or rather Dead Water of the Yukung.

To Greek mythology we must apparently go for the analogue of another portion of the story. The Canon of Yaou seems to hint at Kwan being the son of Yaou, as was Kronos of Ouranos. The jealousy evinced by Yaou of the other is not concealed. Kwan is grudgingly set to work to reduce the swelling waters. Kwan's rule, like that of Kronos, is not successful and he, like his analogue, is deposed in favour, tradition tells us, of his son; who finally succeeds in the person of Yu to the government of the Summer, 夏 Hia region, or rather apparently 霞 Hia the Bright, the kingdom of the gleaming Hari or Vishnu.

After twenty-eight years, i.e. passing through the twenty-eight lunar mansions, and so making a complete circuit of the heaven, the Emperor (Yaou) departed, the people mourning him for three years. Wushun proceeded to (the temple of) the

10 Id. Vol. IV. 86.

accomplished ancestor on the first day of the first month. Assuming the power in his own person.

"He traversed[11] the four Yok
"Burst open the four gates
"Permeated the four intelligences (聰).
"O, you twelve Herdsmen said he
"Provide our food in due season
"Be courteous to the distant and control the near.
"Honour the virtuous, confide in the good;
"Oppose the artful men,
"And the Man and I will follow submissively."

He following the example of his predecessor enquires of those around him for a capable minister. Bak, Lord, (Sanscrit pûjâ *honor*, etc.) Yü (or Manu) is presented to regulate the waters and land. Yü does obeisance and wishes to decline in favour of Dsik (Daksha), Sit (Çesha), or Kaou yaou (Kuvera), but Wushun charges him to take the office.

He appoints Dsik to sow the ground for the Lîmin, (Agricultural or Aryan men;) Sit to instruct them in their civil duties; Kaou yaou to punish the evil doers. Siu to be superintendent of works; Yik (Vaksh) his general supervisor; I (? Sara) to preside over ceremonies; K'wei (? Garga) over music; Sung to be his mouth-piece.

The emperor said "O, ye twenty-two men be reverent according to the season, trusting to the merits of Heaven."

For thirty-three years Wushun occupies the throne, when the legend shows a diversity from the corresponding Indian story. Wushun desires to be relieved and calls on Yu to lead the people. In the Indian legend Manu is saved from the inundating waters by the interposition of Vishnu, who as a fish tows the ark in which the sage has taken refuge to the northern mountains, thence to descend and populate the earth. In Chinese story Yu or Manu himself takes an active part in draining off the water.

Yu declines the proposed honour in favour of Kaou-yaou, as one in whom the Lî (Aryan) men have confidence. Wushun praising Kaou-yaou's administration as minister of justice insists on Yu's acceptance, stating that in due time the appointment of Heaven will fall on him. Yü still declines and wishes to refer the matter to divination, but Wushun, having previously consulted the tortoise and the grass, refuses. Yu after pressing

11 徇 rather than 詢.

accepts, and receives the appointment at early dawn on the first day of the first month.

Wushun charges him to attack the chief of the Miaou (Çambara). For thirty years he carries on the contest but does not succeed, till Yik (Vach) advises Yü to withdraw his troops and try persuation. In seventy days the prince comes to make submission.[12]

Scarcely inferior to Yü in the legend is the place occupied by Kaou yaou, and here the Greek version of the legend again comes to our assistance. Ploutôn the king of Hades cannot be separated from Ploutos the wealthy. So in the Indian story Kuvera is the god of wealth. "Hence," says Cox (Aryan mythology II. 319) "as containing the forms of all future harvests this unseen region becomes at once a land of boundless wealth, even if we take no thought of the gold, silver and other metals stored up in its secret places." Its king is the "wealthiest of all monarchs, and must be addressed not as Hades the unseen, but as Ploutôn the wealthy, the Kuvera of the Ramayana."

In the Chinese version we are not reminded of the wealth of Kaou-yaou, but the Shûking is full of his uncompromising justice. He employs, as minister of Wushun, the five punishments, and the five banishments with their several places of detention, for which three localities are assigned. He is closely associated with the Sze-yok; apparently the Ruler of Hades, though from similarity of sound seemingly confounded with the Sze-yok, the four sacred mountains.

Wushun in many other particulars recalls the legends of the west. Like his analogue he must be wived, and accordingly Yaou bestows on him his two daughters; a proceeding which seems unaccountable to the Chinese, but readily explained when we find that the legend is but one of a series, each marked by the same peculiarity. These names, we are told, were Wo wang the literal equivalent of Sanscrit Ahar the

12 Yik, the correlative of Vach the goddess of speech, equivalent to the Greek Peitho, appears here in his natural character. Like Vach Yik has other parts to fill. He is, above, the lieutenant of Wushun, calculating and selecting, and having authority over all living things (grass, trees, birds and beasts). In a somewhat similar capacity, while Yü drains off the waters Yik teaches the people to eat flesh. So Vach is instrumental as the helpmate of Prajâpati in the creation of all things, traversing and pervading the universe.

day, and Nüying apparently connected with Νύξ, Nakta, the night; both naturally daughters of Ouranos, the overarching heaven. So Herakles is matched with the fifty daughters of Thespius, and Appollôn pursues the gentle Daphne nor is constant to her. The Hindoo legends of Krishna and the maidens recall the same tale of the ever vivifying sun.

The Chinese myth is, however, broken off abruptly by the entrance of Yu on the scene. The celestials (Ti) give place to the human progenitor of the race, and Yu and his successors appear as simple Wang's. Hence Wushun's son Shang K'iuen retires into obscurity.

Nor do we learn much of the death of Wushun. The halo surrounding the departure of Herakles is not here repeated. He ascended, we learn, to the upper regions and there died. Before his death he dwelt in Ming ti'aou, *i. e.* Mandara one of the buttresses of the golden mountain Meru, and died in Mount Tsang-wu, the S*r*ingi of the Indian cosmogany.

Indeed nothing is more conclusive as to the extra-Chinese origin of the early legends than the evident coincidence of the geography of the Chinese stories and that of Indian tradition. The Vishnu Purâ*n*a gives a scheme of cosmography in which we can detect many resemblances too close to be occidental. In the centre of the universe is the golden mountain Meru, the Mûng of the Yükung. North lie mounts Nila, Sweta and S*r*ingi, the latter the place of Wushun's decease. South we have Himavat, Himakûta and Nishadha. Between the ranges we have the different varthas; Bhârata; Kunpurusha; Harivartha, Fuhia of Wushun; and north of Meru, Ramyaka; Hiranyuga and Uttarakuru.

Butressing Meru are to the east Mandara, Mingti'aou of the legend, famous again as the site of T'ang ch'eng's great battle; south, Gandhamâduna; west, Vipula; and north Saparvça, from which flow respectively the four rivers Çıtà, Alakananda, Chaksu and Bhadra.

The attributes of Wushun are equally clear. The Siuen-ki, revolving disk, and the Yuk hang, gemmous balance, tell themselves of the discus and conch of Vishnu. His shield and spear, lute and bow are as characteristic of Appollôn or K*r*ishna as of the Chinese hero. Strangely enough he is absent from the Book of Poetry. Wu wang and Chow kung in it adorn the dawn legends of the conquering race. Wushun in fact appears to have belonged more especially to the elder Aryan tribes who

had effected a settlement before the battle of Mûkye gave the opportunity of founding the first Chinese kingdom; and the legend was probably worked into the tangled net of so called Chinese history, when the policy of the Chows dictated an amalgamation of all the immigrant tribes to found the first Chinese empire.

If any trace of legend, characterizing by that term the first remembrance of actual events as opposed to myth, still survived at that period, it has long disappeared. The tale of Wu shun affords no historic ground to assist in building up the fabric of history. Our messenger sent forth most fain return, for the swelling waters of forgetfulness still prevail, and in the words of the Shûking overtop the mountains.

Next, however, to reconstructing history is the advantage of shattering false beliefs. The unquestioning faith placed in the credibility of the so called early records of China has not a little tended to confuse our notions of early history. It is at least something to know that beyond a certain point we cannot go. The very knowledge that the early stories were myths, and the experience gained in comparing them with their analogues, will serve us in good stead when we come to enquire what light is really thrown on the early history of mankind by the archaic records of China.